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# THE WALSH-SUZZALLO ARITHMETICS

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SIXTH YEAR BOOK



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# WALSH-SUZZALLO ARITHMETICS

BY

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THE CITY OF NEW YORK

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**By Grades**

SIXTH YEAR

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## THE WALSH-SUZZALLO ARITHMETICS

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- II. Essentials
- III. Business and Industrial Practice

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- I. Fundamental Processes
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- I. Third Year Arithmetic
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## PREFACE

THESE books will develop all the mathematical power needed by the average person in the accurate control of his affairs. The purpose has been to teach first the most important topics of arithmetic and last those least frequently used. In consequence, the teacher may feel that the child who is leaving school at the end of any particular grade has been taught whatever would be most useful to him, considering that his schooling had to stop just then. Nothing in the next grade beyond is more important than what he has just studied.

These books are so constructed as to complete the fundamental processes of arithmetic by the end of the sixth year of school life. No pupil studying from this course through the first six years will be left without an essential mathematical power. With this foundation, he can proceed by himself, as need confronts him, to learn shorter or more convenient methods of calculation and to make new applications of the processes learned.

Furthermore, it may be said that in attaining a higher social utility in the arrangement of these books, nothing of teaching efficiency has been sacrificed. In completing the fundamentals in six school years, nothing radical or experimental has been done! Every topic in arithmetic



which these books require to be taught at a particular time in the fourth, fifth, or sixth year is now already successfully taught at that period in some progressive school or school system. The authors have merely combined the successful practices of many efficient schools into a unified scheme of procedure, now urgently demanded by all who understand the needs of those who cannot remain in school eight years.

In addition to giving the child all the fundamental skills of calculation, room has been found for the introduction of those simple institutional applications which are likely to be among the immediate needs of those who leave school early. Every child who completes the sixth grade will know something of being accurate and business-like about his own earning, spending, and saving. He will comprehend the simplest methods of accounting which are to aid him in his own modest affairs, whether these relate to the industrial payroll, the farm income, the household expenditure, or the savings in the bank. Thus every real economy in the teaching of arithmetic has enhanced efficiency.

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# ARITHMETIC

## SIXTH YEAR

### SECTION I

#### INTRODUCTORY REVIEW

At frequent intervals, a few minutes of an arithmetic period should be spent in rapid oral reviews, employing the drills and the sight exercises of this section.

#### Fraction Drills

Express fractions in the answers in their lowest terms.

1. Add:

a.	$\frac{1}{3}$	b.	$\frac{2}{5}$	c.	$\frac{4}{9}$	d.	$\frac{2}{5}$	e.	$\frac{2}{9}$	f.	$\frac{4}{9}$
	$+\frac{1}{3}$		$+\frac{1}{5}$		$+\frac{1}{9}$		$+\frac{2}{5}$		$+\frac{2}{9}$		$+\frac{4}{9}$

g.	$\frac{2}{3}$	h.	$\frac{3}{5}$	i.	$\frac{5}{9}$	j.	$\frac{2}{3}$	k.	$\frac{4}{5}$	l.	$\frac{8}{9}$
	$+\frac{1}{3}$		$+\frac{2}{5}$		$+\frac{4}{9}$		$+\frac{2}{3}$		$+\frac{3}{5}$		$+\frac{5}{9}$

m.	$3\frac{1}{3}$	n.	$4\frac{2}{5}$	o.	$6\frac{4}{9}$	p.	$3\frac{2}{5}$	q.	$6\frac{2}{9}$	r.	$8\frac{4}{9}$
	$+\frac{1}{3}$		$+\frac{1}{5}$		$+\frac{1}{9}$		$+\frac{2}{5}$		$+\frac{2}{9}$		$+\frac{4}{9}$

s.	$5\frac{2}{3}$	t.	$6\frac{3}{5}$	u.	$9\frac{5}{9}$	v.	$6\frac{2}{3}$	w.	$5\frac{4}{5}$	x.	$13\frac{8}{9}$
	$+\frac{1}{3}$		$+\frac{2}{5}$		$+\frac{4}{9}$		$+\frac{2}{3}$		$+\frac{2}{5}$		$+\frac{5}{9}$

## 2. Give sums:

$$\begin{array}{llll} a. & 4\frac{1}{8} & b. & 5\frac{2}{5} \\ & + 3\frac{1}{8} & & + 6\frac{1}{5} \end{array}$$

$$\begin{array}{l} c. \quad 9\frac{4}{9} \\ + 2\frac{1}{9} \end{array}$$

$$\begin{array}{l} d. \quad 5\frac{2}{5} \\ + 6\frac{2}{5} \end{array}$$

$$\begin{array}{l} e. \quad 8\frac{2}{9} \\ + 7\frac{2}{9} \end{array}$$

$$\begin{array}{l} f. \quad 6\frac{4}{9} \\ + 9\frac{4}{9} \end{array}$$

$$\begin{array}{l} g. \quad 4\frac{2}{3} \\ + 3\frac{1}{3} \end{array}$$

$$\begin{array}{l} h. \quad 6\frac{2}{5} \\ + 3\frac{2}{5} \end{array}$$

$$\begin{array}{l} i. \quad 8\frac{5}{9} \\ + 4\frac{4}{9} \end{array}$$

$$\begin{array}{l} j. \quad 9\frac{2}{3} \\ + 8\frac{2}{3} \end{array}$$

$$\begin{array}{l} k. \quad 7\frac{4}{5} \\ + 6\frac{4}{5} \end{array}$$

$$\begin{array}{l} l. \quad 2\frac{8}{9} \\ + 3\frac{5}{9} \end{array}$$

$$\begin{array}{l} m. \quad \frac{1}{4} \\ + \frac{1}{4} \end{array}$$

$$\begin{array}{l} n. \quad 4\frac{1}{6} \\ + \frac{1}{6} \end{array}$$

$$\begin{array}{l} o. \quad \frac{5}{8} \\ + 3\frac{1}{8} \end{array}$$

$$\begin{array}{l} p. \quad 5\frac{7}{12} \\ + 9\frac{1}{12} \end{array}$$

$$\begin{array}{l} q. \quad \frac{3}{8} \\ + \frac{3}{8} \end{array}$$

$$\begin{array}{l} r. \quad 5\frac{4}{9} \\ + \frac{2}{9} \end{array}$$

$$\begin{array}{l} s. \quad \frac{3}{10} \\ + 8\frac{3}{10} \end{array}$$

$$\begin{array}{l} t. \quad 9\frac{5}{12} \\ + 3\frac{5}{12} \end{array}$$

$$\begin{array}{l} u. \quad \frac{7}{8} \\ + \frac{5}{8} \end{array}$$

$$\begin{array}{l} v. \quad 3\frac{8}{9} \\ + \frac{7}{9} \end{array}$$

$$\begin{array}{l} w. \quad \frac{7}{10} \\ + 9\frac{9}{10} \end{array}$$

$$\begin{array}{l} x. \quad 3\frac{5}{12} \\ + 7\frac{1}{12} \end{array}$$

## 3. Subtract:

$$\begin{array}{l} a. \quad \frac{4}{5} \\ - \frac{1}{5} \end{array}$$

$$\begin{array}{l} b. \quad \frac{7}{9} \\ - \frac{5}{9} \end{array}$$

$$\begin{array}{l} c. \quad 6\frac{2}{5} \\ - \frac{2}{5} \end{array}$$

$$\begin{array}{l} d. \quad 7\frac{8}{9} \\ - \frac{4}{9} \end{array}$$

$$\begin{array}{l} e. \quad 7\frac{4}{5} \\ - 2\frac{2}{5} \end{array}$$

$$\begin{array}{l} f. \quad 6\frac{5}{9} \\ - 4\frac{4}{9} \end{array}$$

$$\begin{array}{l} g. \quad 8 \\ - \frac{1}{3} \end{array}$$

$$\begin{array}{l} h. \quad 6 \\ - \frac{2}{5} \end{array}$$

$$\begin{array}{l} i. \quad 7 \\ - \frac{5}{9} \end{array}$$

$$\begin{array}{l} j. \quad 4 \\ - 3\frac{2}{3} \end{array}$$

$$\begin{array}{l} k. \quad 6 \\ - 5\frac{2}{5} \end{array}$$

$$\begin{array}{l} l. \quad 8 \\ - 7\frac{5}{9} \end{array}$$

$$\begin{array}{l} m. \quad 8 \\ - 1\frac{1}{3} \end{array}$$

$$\begin{array}{l} n. \quad 6 \\ - 1\frac{2}{5} \end{array}$$

$$\begin{array}{l} o. \quad 7 \\ - 1\frac{5}{9} \end{array}$$

$$\begin{array}{l} p. \quad 9 \\ - 3\frac{2}{3} \end{array}$$

$$\begin{array}{l} q. \quad 6 \\ - 4\frac{2}{5} \end{array}$$

$$\begin{array}{l} r. \quad 8 \\ - 2\frac{5}{9} \end{array}$$

$$\begin{array}{l} s. \quad 8\frac{1}{3} \\ - 1\frac{2}{3} \end{array}$$

$$\begin{array}{l} t. \quad 6\frac{1}{5} \\ - 1\frac{2}{5} \end{array}$$

$$\begin{array}{l} u. \quad 7\frac{1}{9} \\ - 1\frac{5}{9} \end{array}$$

$$\begin{array}{l} v. \quad 9\frac{1}{3} \\ - 4\frac{2}{3} \end{array}$$

$$\begin{array}{l} w. \quad 6\frac{2}{5} \\ - 4\frac{2}{5} \end{array}$$

$$\begin{array}{l} x. \quad 8\frac{4}{9} \\ - 2\frac{5}{9} \end{array}$$

## 4. Give answers:

$$a. \quad \frac{1}{3} \times 2$$

$$b. \quad 3 \times \frac{1}{4}$$

$$c. \quad \frac{1}{5} \text{ of } 4$$

$$d. \quad 5 \times \frac{1}{6}$$

$$e. \quad \frac{1}{7} \times 9$$

$$f. \quad 17 \times \frac{1}{8}$$

$$g. \quad \frac{1}{9} \text{ of } 23$$

$$h. \quad 31 \times \frac{1}{10}$$

$$i. \quad \frac{2}{5} \times 2$$

$$j. \quad 3 \times \frac{2}{7}$$

$$k. \quad \frac{5}{6} \text{ of } 5$$

$$l. \quad 7 \times \frac{5}{8}$$

## 5. Give products :

$$\begin{array}{r} a. \ 3\frac{1}{2} \\ \times 2 \\ \hline \end{array}$$

$$\begin{array}{r} b. \ 5\frac{1}{4} \\ \times 3 \\ \hline \end{array}$$

$$\begin{array}{r} c. \ 7\frac{1}{5} \\ \times 4 \\ \hline \end{array}$$

$$\begin{array}{r} d. \ 9\frac{1}{8} \\ \times 5 \\ \hline \end{array}$$

$$\begin{array}{r} e. \ 8\frac{1}{7} \\ \times 6 \\ \hline \end{array}$$

$$\begin{array}{r} f. \ 2\frac{2}{5} \\ \times 2 \\ \hline \end{array}$$

$$\begin{array}{r} g. \ 5\frac{2}{7} \\ \times 3 \\ \hline \end{array}$$

$$\begin{array}{r} h. \ 7\frac{5}{8} \\ \times 5 \\ \hline \end{array}$$

$$\begin{array}{r} i. \ 3\frac{2}{9} \\ \times 8 \\ \hline \end{array}$$

$$\begin{array}{r} j. \ 9\frac{1}{8} \\ \times 7 \\ \hline \end{array}$$

$$\begin{array}{r} k. \ 4\frac{1}{4} \\ \times 2 \\ \hline \end{array}$$

$$\begin{array}{r} l. \ 5\frac{1}{8} \\ \times 4 \\ \hline \end{array}$$

$$\begin{array}{r} m. \ 6\frac{3}{8} \\ \times 2 \\ \hline \end{array}$$

$$\begin{array}{r} n. \ 7\frac{2}{3} \\ \times 3 \\ \hline \end{array}$$

$$\begin{array}{r} o. \ 8\frac{1}{10} \\ \times 6 \\ \hline \end{array}$$

$$\begin{array}{r} p. \ 6\frac{1}{4} \\ \times 6 \\ \hline \end{array}$$

$$\begin{array}{r} q. \ 8\frac{1}{6} \\ \times 9 \\ \hline \end{array}$$

$$\begin{array}{r} r. \ 3\frac{2}{3} \\ \times 3 \\ \hline \end{array}$$

$$\begin{array}{r} s. \ 4\frac{3}{4} \\ \times 4 \\ \hline \end{array}$$

$$\begin{array}{r} t. \ 6\frac{2}{5} \\ \times 5 \\ \hline \end{array}$$

## 6. Give answers:

$$a. \ \frac{1}{4} \text{ of } 2$$

$$b. \ 3 \times \frac{1}{6}$$

$$c. \ \frac{1}{8} \times 4$$

$$d. \ 6 \times \frac{1}{9}$$

$$e. \ \frac{1}{4} \text{ of } 4$$

$$f. \ 6 \times \frac{1}{6}$$

$$g. \ \frac{1}{8} \times 16$$

$$h. \ 27 \times \frac{1}{9}$$

$$i. \ \frac{1}{4} \text{ of } 6$$

$$j. \ 9 \times \frac{1}{6}$$

$$k. \ \frac{1}{8} \times 20$$

$$l. \ 33 \times \frac{1}{9}$$

$$m. \ \frac{3}{8} \text{ of } 2$$

$$n. \ 3 \times \frac{2}{9}$$

$$o. \ \frac{5}{6} \times 3$$

$$p. \ 7 \times \frac{1}{7}$$

$$q. \ \frac{2}{3} \text{ of } 15$$

$$r. \ 24 \times \frac{3}{4}$$

$$s. \ \frac{5}{8} \times 12$$

$$t. \ 3 \times \frac{7}{7}$$

## 7. Divide:

$$a. \ 2 \overline{)4 \text{ fifths}}$$

$$b. \ 3 \overline{)6 \text{ sevenths}}$$

$$c. \ 4 \overline{)8 \text{ ninths}}$$

NOTE. In dividing  $\frac{4}{5}$  by 2, think 2 into 4 fifths, or  $\frac{1}{2}$  of 4 fifths, or 4 fifths divided by 2. Do not change the mixed number in the dividend to an improper fraction.

$$a. \ 7 \overline{)14\frac{4}{5}}$$

$$b. \ 8 \overline{)2\frac{6}{5}}$$

$$c. \ 5 \overline{)2\frac{5}{6}}$$

$$d. \ 6 \overline{)1\frac{2}{3}}$$

$$e. \ 2 \overline{)4\frac{4}{5}}$$

$$f. \ 3 \overline{)6\frac{6}{7}}$$

$$g. \ 4 \overline{)8\frac{8}{9}}$$

$$h. \ 5 \overline{)5\frac{5}{6}}$$

$$i. \ 2 \overline{)1\frac{1}{2}}$$

$$j. \ 3 \overline{)1\frac{1}{3}}$$

$$k. \ 4 \overline{)1\frac{1}{2}}$$

$$l. \ 5 \overline{)1\frac{1}{5}}$$

$$m. \ 2 \overline{)12\frac{1}{2}}$$

$$n. \ 3 \overline{)9\frac{1}{3}}$$

$$o. \ 4 \overline{)16\frac{1}{2}}$$

$$p. \ 5 \overline{)15\frac{1}{5}}$$

8. Give quotients:

- |                                  |                                  |                                  |                                  |
|----------------------------------|----------------------------------|----------------------------------|----------------------------------|
| a. $6 \overline{)18\frac{1}{2}}$ | b. $7 \overline{)21\frac{1}{2}}$ | c. $8 \overline{)40\frac{1}{2}}$ | d. $9 \overline{)63\frac{1}{2}}$ |
| e. $5 \overline{)5\frac{1}{2}}$  | f. $5 \overline{)2\frac{1}{2}}$  | g. $2 \overline{)4\frac{1}{2}}$  | h. $2 \overline{)1\frac{1}{2}}$  |
| i. $4 \overline{)2\frac{3}{4}}$  | j. $5 \overline{)3\frac{3}{4}}$  | k. $6 \overline{)3\frac{3}{4}}$  | l. $7 \overline{)4\frac{3}{4}}$  |
| m. $2 \overline{)19\frac{1}{2}}$ | n. $4 \overline{)26\frac{3}{4}}$ | o. $5 \overline{)28\frac{3}{4}}$ | p. $6 \overline{)33\frac{3}{4}}$ |
| q. $2 \overline{)2\frac{3}{4}}$  | r. $2 \overline{)1\frac{1}{2}}$  | s. $3 \overline{)4\frac{1}{2}}$  | t. $3 \overline{)1\frac{1}{2}}$  |
| u. $2 \overline{)17\frac{1}{2}}$ | v. $3 \overline{)16\frac{1}{2}}$ | w. $4 \overline{)19\frac{1}{2}}$ | x. $5 \overline{)42\frac{3}{4}}$ |

9. *Preparatory Exercises.*

a. How many baseballs at  $\$ \frac{1}{2}$  each can be purchased for  $\$ \frac{1}{2}$ ? For  $\$ 1$ ? For  $\$ 1\frac{1}{2}$ ?

- |   |                                 |   |                                 |   |
|---|---------------------------------|---|---------------------------------|---|
| b. $\frac{1}{2} \overline{)1\frac{1}{2}}$ | c. $\frac{1}{2} \overline{)1}$  | d. $\frac{1}{2} \overline{)1\frac{1}{2}}$ | e. $\frac{1}{2} \overline{)2}$  | f. $\frac{1}{2} \overline{)2\frac{1}{2}}$ |
| g. $\frac{1}{2} \overline{)8}$            | h. $\frac{1}{2} \overline{)20}$ | i. $\frac{1}{3} \overline{)6}$            | j. $\frac{1}{3} \overline{)12}$ | k. $\frac{1}{4} \overline{)12}$           |

How is the quotient obtained in each case?

- |   |  |   |                                 |                                 |
|---|--|---|---------------------------------|---------------------------------|
| l. $\frac{3}{2} \overline{)3\frac{3}{2}}$ | m. $1\frac{1}{2} \overline{)1\frac{1}{2}}$ | n. $\frac{3}{2} \overline{)6\frac{3}{2}}$ | o. $1\frac{1}{2} \overline{)3}$ | p. $1\frac{1}{2} \overline{)6}$ |
|---|--|---|---------------------------------|---------------------------------|

Multiply the divisor and the dividend in each of the five preceding examples by 2.

- |                      |                      |                      |                      |                       |
|----------------------|----------------------|----------------------|----------------------|-----------------------|
| q. $3 \overline{)3}$ | r. $3 \overline{)3}$ | s. $3 \overline{)6}$ | t. $3 \overline{)6}$ | u. $3 \overline{)12}$ |
|----------------------|----------------------|----------------------|----------------------|-----------------------|

How do the quotients compare in each case?

v. Divide 12 by  $1\frac{1}{2}$ .

$$\begin{array}{r} 1\frac{1}{2} \overline{)12} \\ \times 2 \times 2 \\ \hline 3 \overline{)24} \\ \hline 8 \text{ Ans.} \end{array}$$

PROOF.  $1\frac{1}{2} \times 8 = 12$ .

w. Divide 21 by  $\frac{3}{4}$ .

$$\begin{array}{r} \frac{3}{4} \overline{)21} \\ \times 4 \times 4 \\ \hline 3 \overline{)84} \\ \hline 28 \text{ Ans.} \end{array}$$

PROOF.  $28 \times \frac{3}{4} = 21$ .

## 10. Give quotients.

Change the divisor to a whole number by multiplying the divisor by the denominator of the fraction, and multiply the dividend by the same number. Divide the new dividend by the new divisor.

- |                      |                      |                     |                                 |                               |
|----------------------|----------------------|---------------------|---------------------------------|-------------------------------|
| a. $1\frac{1}{2})9$  | b. $2\frac{1}{2})15$ | c. $\frac{3}{4})12$ | d. $1\frac{1}{2})7\frac{1}{2}$  | e. $\frac{3}{4})2\frac{1}{4}$ |
| f. $1\frac{1}{2})15$ | g. $3\frac{1}{2})21$ | h. $\frac{2}{3})12$ | i. $1\frac{1}{4})8\frac{3}{4}$  | j. $\frac{3}{8})2\frac{3}{8}$ |
| k. $1\frac{1}{2})18$ | l. $2\frac{1}{4})27$ | m. $\frac{4}{5})12$ | n. $1\frac{1}{3})9\frac{1}{3}$  | o. $\frac{4}{5})4\frac{4}{5}$ |
| p. $1\frac{1}{4})15$ | q. $3\frac{1}{4})26$ | r. $\frac{5}{6})10$ | s. $1\frac{1}{4})7\frac{1}{2}$  | t. $\frac{5}{8})5\frac{5}{8}$ |
| u. $1\frac{1}{4})20$ | v. $1\frac{3}{8})15$ | w. $\frac{7}{8})14$ | x. $1\frac{2}{3})16\frac{2}{3}$ | y. $\frac{4}{7})6\frac{4}{7}$ |

*Oral Problems*

1. A farmer sold  $15\frac{1}{2}$  cords of wood in January and  $10\frac{1}{2}$  cords in February. How many cords did he sell in all?
2. From a piece of cloth containing 30 yards,  $12\frac{1}{2}$  yards are sold. How many yards remain?
3. A rectangular field is  $12\frac{1}{4}$  rods long and  $7\frac{1}{4}$  rods wide. How many rods of fence will be needed to inclose it?
4. How many  $\frac{1}{2}$ -pound packages will  $24\frac{1}{2}$  pounds of candy make?
5. A traveler walked  $60\frac{3}{4}$  miles in 3 days. How many miles a day did he average?
6. How many square rods are there in a field  $20\frac{1}{2}$  rods long and 10 rods wide?
7. Mr. Yates pays \$ $17\frac{1}{4}$  for carpet and \$ $20\frac{1}{4}$  for furniture. What is the amount of his bill?
8. How many minutes are there in  $\frac{1}{8}$  of a day?
9. At 60 pounds per bushel, what will  $\frac{3}{4}$  bushel weigh?
10. How many yards of cloth at \$ $1\frac{1}{2}$  per yard can be bought for \$12?



*Written Problems*

1. A horse traveled  $48\frac{3}{10}$  miles in one day,  $56\frac{3}{4}$  the next,  $40\frac{1}{2}$  the third, and  $45\frac{7}{10}$  the fourth. How far did he travel in all?

2. To the sum of  $6\frac{7}{8}$  and  $19\frac{3}{8}$  add their difference.

3. From a bin containing  $25\frac{3}{8}$  bushels of grain there were taken out  $5\frac{3}{4}$  bushels at one time and  $6\frac{1}{2}$  at another. How much remained?

4. A merchant sold 4 pieces of cloth containing  $27\frac{1}{2}$  yards,  $26\frac{3}{8}$  yards,  $29\frac{5}{8}$  yards, and  $28\frac{1}{8}$  yards, respectively. How much did he receive for the cloth at 96 cents per yard?

5. Reduce  $\frac{189}{52}$  to lowest terms.

6. A man has  $8\frac{5}{16}$  bushels of peanuts. He puts them into bags holding  $\frac{1}{8}$  bushel. How many bags does he fill?

7. A 160-acre farm consists of five fields; the first contains  $17\frac{3}{5}$  acres, the second  $29\frac{1}{4}$  acres, the third  $35\frac{7}{10}$  acres, the fourth  $22\frac{8}{5}$  acres. How many acres are there in the fifth field?

8. From a piece of silk that contained  $28\frac{1}{2}$  yards, there were sold  $2\frac{1}{2}$  yards,  $6\frac{1}{4}$  yards, and  $13\frac{3}{4}$  yards. Find the value of the remainder at \$1.20 per yard.

9. Three pieces of cloth bought at \$2 per yard cost \$150. The first piece measures  $23\frac{1}{2}$  yards, the second measures  $30\frac{3}{8}$  yards. How many yards in the third piece?

10. What part of a person's income remains after he spends  $\frac{1}{3}$ ,  $\frac{4}{15}$ , and  $\frac{1}{5}$  of it?

11. A boy loses  $\frac{1}{2}$  of his marbles, and he gives away  $\frac{1}{4}$  of them. If he has 17 marbles left, how many had he at first?

Write from the blackboard or the textbook the answers to the following examples:

## 1. Add:

$$\begin{array}{r} a. \ 24\frac{1}{2} \\ + 3\frac{3}{4} \\ \hline \end{array}$$

$$\begin{array}{r} b. \ 17\frac{3}{8} \\ + 5\frac{1}{6} \\ \hline \end{array}$$

$$\begin{array}{r} c. \ 48\frac{5}{8} \\ + 3\frac{1}{4} \\ \hline \end{array}$$

$$\begin{array}{r} d. \ 42\frac{5}{8} \\ + 8\frac{1}{2} \\ \hline \end{array}$$

$$\begin{array}{r} e. \ 8\frac{1}{2} \\ + 36\frac{2}{3} \\ \hline \end{array}$$

$$\begin{array}{r} f. \ 84\frac{13}{18} \\ + 9\frac{1}{4} \\ \hline \end{array}$$

$$\begin{array}{r} g. \ 93\frac{1}{4} \\ + 7\frac{3}{8} \\ \hline \end{array}$$

$$\begin{array}{r} h. \ 3\frac{3}{4} \\ + 91\frac{1}{6} \\ \hline \end{array}$$

$$\begin{array}{r} i. \ 46\frac{5}{9} \\ + 7\frac{1}{6} \\ \hline \end{array}$$

$$\begin{array}{r} j. \ 24\frac{1}{2} \\ \quad 6\frac{3}{4} \\ + 59\frac{1}{8} \\ \hline \end{array}$$

$$\begin{array}{r} k. \ 40\frac{1}{3} \\ \quad 28\frac{1}{6} \\ + 5\frac{1}{12} \\ \hline \end{array}$$

$$\begin{array}{r} l. \ 47\frac{1}{2} \\ \quad 7\frac{3}{4} \\ + 59\frac{1}{16} \\ \hline \end{array}$$

$$\begin{array}{r} m. \ 47\frac{3}{8} \\ \quad 18\frac{1}{2} \\ \quad 8\frac{1}{6} \\ \hline \end{array}$$

$$\begin{array}{r} n. \ 48\frac{1}{3} \\ \quad 32\frac{1}{6} \\ \quad 7\frac{1}{2} \\ \hline \end{array}$$

$$\begin{array}{r} o. \ 46\frac{1}{2} \\ \quad 8\frac{7}{8} \\ + 32\frac{1}{16} \\ \hline \end{array}$$

$$\begin{array}{r} p. \ 84\frac{1}{2} \\ \quad 10\frac{3}{8} \\ \quad 3\frac{1}{10} \\ \hline \end{array}$$

$$\begin{array}{r} q. \ 23\frac{1}{2} \\ \quad 45\frac{3}{8} \\ \quad 6\frac{1}{4} \\ \hline \end{array}$$

$$\begin{array}{r} r. \ 30\frac{3}{8} \\ \quad 41\frac{1}{4} \\ + 5\frac{1}{12} \\ \hline \end{array}$$

## 2. Subtract:

$$\begin{array}{r} a. \ 18\frac{3}{4} \\ - 6\frac{1}{2} \\ \hline \end{array}$$

$$\begin{array}{r} b. \ 72\frac{1}{2} \\ - 2\frac{1}{6} \\ \hline \end{array}$$

$$\begin{array}{r} c. \ 40\frac{7}{8} \\ - 4\frac{1}{2} \\ \hline \end{array}$$

$$\begin{array}{r} d. \ 54\frac{1}{2} \\ - 3\frac{1}{8} \\ \hline \end{array}$$

$$\begin{array}{r} e. \ 27\frac{1}{2} \\ - 5\frac{3}{8} \\ \hline \end{array}$$

$$\begin{array}{r} f. \ 80\frac{1}{4} \\ - 7\frac{1}{8} \\ \hline \end{array}$$

$$\begin{array}{r} g. \quad 361\frac{1}{3} \\ - 91\frac{1}{2} \\ \hline \end{array}$$

$$\begin{array}{r} h. \quad 621\frac{1}{10} \\ - 81\frac{1}{2} \\ \hline \end{array}$$

$$\begin{array}{r} i. \quad 931\frac{1}{6} \\ - 101\frac{1}{3} \\ \hline \end{array}$$

$$\begin{array}{r} j. \quad 841\frac{1}{4} \\ - 297\frac{1}{8} \\ \hline \end{array}$$

$$\begin{array}{r} k. \quad 401\frac{1}{2} \\ - 16\frac{5}{6} \\ \hline \end{array}$$

$$\begin{array}{r} l. \quad 631\frac{1}{2} \\ - 27\frac{3}{8} \\ \hline \end{array}$$

$$\begin{array}{r} m. \quad 901\frac{1}{16} \\ - 261\frac{1}{2} \\ \hline \end{array}$$

$$\begin{array}{r} n. \quad 60\frac{5}{8} \\ - 23\frac{5}{6} \\ \hline \end{array}$$

$$\begin{array}{r} o. \quad 521\frac{1}{16} \\ - 347\frac{1}{8} \\ \hline \end{array}$$

$$\begin{array}{r} p. \quad 78\frac{5}{12} \\ - 39\frac{3}{4} \\ \hline \end{array}$$

$$\begin{array}{r} q. \quad 45\frac{7}{10} \\ - 18\frac{1}{5} \\ \hline \end{array}$$

$$\begin{array}{r} r. \quad 93\frac{3}{8} \\ - 47\frac{1}{6} \\ \hline \end{array}$$

## 3. Multiply:

$$\begin{array}{r} a. \quad 121\frac{1}{2} \\ \times 8 \\ \hline \end{array}$$

$$\begin{array}{r} b. \quad 16 \\ \times 41\frac{1}{2} \\ \hline \end{array}$$

$$\begin{array}{r} c. \quad 101\frac{1}{6} \\ \times 12 \\ \hline \end{array}$$

$$\begin{array}{r} d. \quad 20\frac{2}{3} \\ \times 9 \\ \hline \end{array}$$

$$\begin{array}{r} e. \quad 24 \\ \times 21\frac{1}{3} \\ \hline \end{array}$$

$$\begin{array}{r} f. \quad 12\frac{3}{7} \\ \times 7 \\ \hline \end{array}$$

$$\begin{array}{r} g. \quad 21\frac{3}{4} \\ \times 4 \\ \hline \end{array}$$

$$\begin{array}{r} h. \quad 48 \\ \times 11\frac{1}{8} \\ \hline \end{array}$$

$$\begin{array}{r} i. \quad 40\frac{5}{9} \\ \times 9 \\ \hline \end{array}$$

$$\begin{array}{r} j. \quad 124\frac{1}{2} \\ \times 7 \\ \hline \end{array}$$

$$\begin{array}{r} k. \quad 304\frac{5}{6} \\ \times 12 \\ \hline \end{array}$$

$$\begin{array}{r} l. \quad 251\frac{2}{11} \\ \times 10 \\ \hline \end{array}$$

$$\begin{array}{r} m. \quad 320\frac{2}{3} \\ \times 8 \\ \hline \end{array}$$

$$\begin{array}{r} n. \quad 423\frac{4}{7} \\ \times 2 \\ \hline \end{array}$$

$$\begin{array}{r} o. \quad 222\frac{8}{10} \\ \times 13 \\ \hline \end{array}$$

$$\begin{array}{r} p. \quad 621\frac{3}{4} \\ \times 5 \\ \hline \end{array}$$

$$\begin{array}{r} q. \quad 516\frac{5}{9} \\ \times 5 \\ \hline \end{array}$$

$$\begin{array}{r} r. \quad 201\frac{1}{9} \\ \times 14 \\ \hline \end{array}$$

## 4. Divide:

a.  $2 \overline{)26\frac{1}{2}}$

b.  $7 \overline{)78\frac{1}{8}}$

c.  $6 \overline{)67\frac{1}{4}}$

d.  $3 \overline{)39\frac{3}{4}}$

e.  $8 \overline{)17\frac{3}{5}}$

f.  $5 \overline{)51\frac{2}{3}}$

g.  $4 \overline{)36\frac{4}{5}}$

h.  $9 \overline{)36\frac{9}{10}}$

i.  $4 \overline{)27\frac{3}{4}}$

j.  $2 \overline{)246\frac{1}{3}}$

k.  $5 \overline{)849\frac{7}{8}}$

l.  $8 \overline{)649\frac{1}{7}}$

m.  $3 \overline{)459\frac{1}{2}}$

n.  $6 \overline{)273\frac{1}{2}}$

o.  $9 \overline{)833\frac{4}{5}}$

p.  $4 \overline{)723\frac{1}{5}}$

q.  $7 \overline{)723\frac{2}{5}}$

r.  $10 \overline{)537\frac{2}{3}}$

## DECIMAL DRILLS

*Sight Exercises*

## 1. Reduce to common fractions:

a. .5

b. .25

c. .125

d. .375

e. .6

f. .08

g. .16

h. .155

i. .60

j. .625

k. .36

l. .024

m. .84

n. .002

o. .875

p. .075

## 2. Reduce to decimals:

a.  $\frac{1}{4}$

b.  $\frac{1}{8}$

c.  $\frac{1}{20}$

d.  $\frac{5}{8}$

e.  $\frac{1}{50}$

f.  $\frac{2}{25}$

g.  $\frac{3}{5}$

h.  $\frac{6}{25}$

i.  $\frac{3}{20}$

j.  $\frac{3}{4}$

k.  $\frac{7}{50}$

l.  $\frac{4}{50}$

m.  $\frac{3}{8}$

n.  $\frac{11}{20}$

o.  $\frac{7}{8}$

p.  $\frac{3}{40}$

## 3. Multiply:

a.  $300 \times .05$

b.  $484 \times .25$

NOTE. When one of the factors is .25, .125, etc., employ the equivalent common fraction.

c.  $200 \times .06$

d.  $.375 \times 80$

e.  $444 \times .25$

f.  $250 \times .4$

g.  $.25 \times 84$

h.  $848 \times .5$

i.  $300 \times .022$

j.  $.125 \times 16$

k.  $48 \times .625$

l.  $500 \times .12$

m.  $.75 \times 36$

n.  $24 \times .875$

o.  $120 \times .24$

p.  $1.5 \times 18$

q.  $2.4 \times .875$

r.  $150 \times .24$

s.  $.15 \times 18$

t.  $.48 \times .625$

## 4. Divide:

a.  $12 \div .03$

b.  $24 \div .6$

$12 \div .03 = 1200 \div 3.$  Why?

$24 \div .6 = 240 \div 6.$

c.  $22 \div 25$

d.  $15 \div 24$

$22 \div 25 = \frac{22}{25} = \frac{?}{100}.$

$15 \div 24 = \frac{15}{24} = \frac{5}{8} = \frac{?}{1000}.$

e.  $12 \div .25$

$12 \div .25 = 12 \div \frac{1}{4} = 12 \times 4.$

f.  $33 \div .375$

$33 \div .375 = 33 \div \frac{3}{8} = 33 \times \frac{8}{3} = 11 \times 8.$

g.  $8 \div .02$

h.  $15 \div 50$

i.  $11 \div .25$

j.  $18 \div .06$

k.  $24 \div 32$

l.  $22 \div .25$

m.  $24 \div .4$

n.  $16 \div 64$

o.  $36 \div .75$

p.  $88 \div .022$

q.  $18 \div 20$

r.  $21 \div .125$

s.  $54 \div .12$

t.  $30 \div 100$

u.  $12 \div .375$

*Written Exercises*

## 1. Add:

NOTE. Change common fractions to decimals.

$$a. 16\frac{1}{5} + 84.7 + 96\frac{7}{15} + 75\frac{2}{5}$$

$$b. .3 + \frac{27}{50} + 7\frac{1}{125} + 35.309 + .0483$$

$$c. 3\frac{17}{100} + .0087 + 35.348 + .0907 + \frac{1}{80}$$

$$d. .945 + 34.8 + 9.48 + \frac{11}{100} + 826$$

## 2. Subtract:

$$a. 15.36 - .89$$

$$b. 6.51 - 3.429$$

$$c. 18.45 - 9.7$$

$$d. 25.2 - 7.625$$

$$e. 126.344 - 85.9$$

$$f. 55.007 - 4.26$$

$$g. .90072 - .086$$

$$h. 89.4 - 83.576$$

$$i. 17.09 - 3.25$$

$$j. 103.05 - 8.9306$$

$$k. 809.72 - 48.4$$

$$l. .6 - .4725$$

## 3. Multiply:

$$a. 46.78 \text{ by } .93$$

NOTE. In multiplication of decimals, as well as in all other examples, estimate the probable answer before performing the operation. The answer to the foregoing should be less than 46, since .93 is less than 1.

$$b. 9.76 \times 15.4$$

$$c. 7.37 \times .648$$

$$d. 37.68 \times 2.234$$

$$e. 47 \times .8 \times .2$$

$$f. .98 \times .98$$

$$g. .126 \times 48$$

$$h. 30.75 \times .46$$

$$i. 33.343 \times 2.95$$

$$j. 7.08 \times .096$$

$$k. 8.053 \times 1.47$$

$$l. .09 \times 4.56$$

$$m. 76.2 \times 4.86$$

$$n. .0364 \times .82$$

$$o. 14.9 \times .83$$

## 4. Divide 217.32 by .6.

Change .6, the divisor, to 6 by multiplying it by 10. Multiply 217.32 by 10, by moving the decimal point one place to the right, which makes it 2173.2.

$$\begin{array}{r} 6 \overline{)2173.2} \\ 362.2 \end{array} \text{ Ans.}$$

## 5. Divide 1301.3 by .077.

Change 77 thousandths to a whole number by multiplying it by 1000, which moves the decimal point 3 places to the right. Multiply the dividend by 1000 by removing the decimal point and annexing two ciphers, making the new dividend 1301300.

$$\begin{array}{r} 16900 \text{ Ans.} \\ 77 \overline{)1301300} \\ \underline{77} \phantom{00} \\ 531 \phantom{00} \\ \underline{462} \phantom{00} \\ 698 \phantom{00} \\ \underline{698} \phantom{00} \end{array}$$

## 6. Divide 3.576 by 800.

In this case change the divisor to 8 by dividing it by 100. Divide the dividend by 100 by moving the decimal point two places to the left.

$$\begin{array}{r} 8 \overline{)0.03576} \\ .00447 \end{array} \text{ Ans.}$$

## 7. Divide:

a.  $384 \div 3.2$

b.  $.21504 \div 9.6$

c.  $2304 \div .48$

d.  $21.504 \div 240$

e.  $53.95 \div 83$

f.  $3.2 \div .064$

g.  $53.95 \div .65$

h.  $432 \div .012$

i.  $2.436 \div 5.8$

j.  $2.4 \div .096$

k.  $68.6 \div .049$

l.  $38.76 \div 3.4$

m.  $180 \div 1.5$

n.  $18.612 \div .09$

o.  $734.4 \div .6$

p.  $142.4 \div .4$

*Oral Problems*

1. At \$.125 each, what will be the cost of 88 books?  
88 times  $\frac{1}{8}$ .
2. A rectangular field is 8.8 rods long and 25 rods wide.  
How many square rods does it contain?
3. What decimal part of 32 is 8?
4. How many hours are there in .625 days?
5. How many nails can be made from a piece of wire  
125 inches in length, if each nail requires 2.5 inches?
6. At 2.15 pounds per quart, what is the weight of 10  
gallons of milk?
7. The quotient is 2.31, the divisor is .3. What is the  
dividend?
8. What will be the cost of 40,000 bricks at \$6.50 per  
thousand?
9. A farmer sold .75 of a flock of 36 sheep. How many  
sheep did he retain?
10. If a man can do .125 of a piece of work in a day,  
how many days will it take him to do the whole work?
11. What decimal part of a day is 15 hours?
12. Change .4 ton to pounds.



## SECTION II

### DENOMINATE NUMBERS, PERCENTAGE, INTEREST, DECIMALS, MEASUREMENTS, REVIEWS, SHORT METHODS, ACCOUNTS

#### Compound Denominate Numbers

##### *Preparatory Exercises*

1. A girl measured the width of a piece of cloth with a yard stick, and found it to be 1 yd. 1 ft. 6 in. wide. What is the width (*a*) in feet and inches? (*b*) In feet and the fraction of a foot? (*c*) In yards and the fraction of a yard? (*d*) In inches?

2. What fraction of a yard wide is a strip of silk that is (*a*) 27 inches wide? (*b*) 2 ft. 3 in. wide?

3. When an ounce of tea is used daily, (*a*) how many ounces are used in June? (*b*) Give the weight in pounds and ounces. (*c*) In pounds and the fraction of a pound.

Concrete numbers relating to units of measure; such as 3 ounces, 2 feet, 6 inches, 4 pounds, etc., are called *denominate numbers*.

Denominate numbers containing a single unit, such as 3 oz., 2 ft., \$4, 5 bu., etc., are called *simple denominate numbers*. Those containing two or more related units; such as 5 lb. 3 oz., 1 yd. 2 ft. 6 in., 7 A. 80 sq. rd., are called *compound denominate numbers*, or merely *compound numbers*.

## Reductions

*Preparatory Exercises*

1. Change to ounces :

- a. 20 lb.   b. 3 lb.   c.  $\frac{3}{4}$  lb.   d. 1.25 lb.   e.  $1\frac{1}{2}$  lb.  
 f. 1 lb. 9 oz.

*Sight Exercises*

2. Change :

- |                                 |                                 |
|---------------------------------|---------------------------------|
| a. 2 yd. 1 ft. to feet.         | b. $\frac{3}{4}$ yd. to feet.   |
| c. .25 bu. to pecks.            | d. 2 bu. 2 pk. to pecks.        |
| e. $\frac{3}{4}$ lb. to ounces. | f. .5 hr. to minutes.           |
| g. 2 yd. 1 ft. to inches.       | h. $\frac{1}{8}$ bu. to quarts. |
| i. .75 ft. to inches.           | j. 5 lb. 7 oz. to ounces.       |
| k. $\frac{2}{3}$ da. to hours.  | l. .42 T. to pounds.            |
| m. 2 bu. 2 pk. to quarts.       | n. $\frac{3}{4}$ yd. to inches. |
| o. .75 lb. to ounces.           |                                 |

## Reduction Descending

1. How many nails 1 inch long can be made from a piece of wire measuring (a) 12 yd. 2 ft. 6 in.? (b) 17 yd. 2 ft.? (c) 16 yd. 9 in.?

## PROCESS

(a)

12 (yd.) 2 (ft.) 6 (in.)

 $\times 3$  ft.

---

38 (ft.) $\times 12$  in.

---

Ans. 462 (nails)

Since there are 3 feet in a yard, in 12 yards there are 12 times 3 ft., or 36 ft., and in 12 yd. 2 ft. there are 38 ft. Since there are 12 inches in a foot, in 38 feet there are 38 times 12 in., or 456 in., and in 38 ft. 6 in. there are 462 in.

In doing the work, however, use 3 as the first multiplier, and "add in" 2 ft. while performing the multiplication. Then multiply 38 by 12, and "add in" 6 inches.

*Written Exercises*

## 2. Reduce :

- a. 13 yd. 1 ft. 7 in. to inches.      b. 16 yd. 2 ft. to inches.  
 c. 3 mi. 20 rd. 4 yd. to yards.      d. 20 rd. 4 ft. to feet.  
 e. 16 bu. 2 pk. 7 qt. to quarts.      f. 26 bu. 3 pk. to quarts.

**Reduction Ascending***Written Exercises*

1. How many yards, etc., are there in a piece of muslin measuring (a) 462 in? (b) 636 in? (c) 585 in?

## PROCESS

(a) 12 in.) 462 in.      Since there are 12 in.  
       3 ft.) 38 (ft.) 6 in.      in a foot, divide 462 in.  
           12 (yd.) 2 ft. 6 in.      by 12 in., which gives  
    the number of feet as 38,  
 with a remainder of 6 in. After 38 write ft. in a parenthesis.  
 Since there are 3 ft. in a yard, divide 38 ft. by 3 ft., which gives  
 the number of yards as 12, with a remainder of 2 ft. After 12,  
 write yd. in a parenthesis. Bring down 6 in.

(b) 12 in.) 636 in.      (c) 12 in.) 585 in.  
       3 ft.) 53 (ft.)      3 ft.) 48 (ft.) 9 in.  
       Ans. 17 (yd.) 2 ft.      16 (yd.) 9 in.

## 2. Reduce to higher denominations :

- a. 189 in.    b. 284 oz.    c. 3700 sec.    d. 147 pt. (liquid)  
 e. 168 hr.    f. 275 mo.    g. 3700 min.    h. 215 qt. (dry)

*Sight Exercises*

## Change to higher denominations :

- a. 64 oz.    b. 70 oz.    c. 160 oz.    d. 170 oz.    e. 150 min.  
 f. 50 hr.    g. 80 hr.    h. 108 ft.    i. 110 ft.    j. 370 sec.  
 k. 48 mo.    l. 63 mo.    m. 120 mo.    n. 126 mo.    o. 100 mo.

*Sight Problems*

1. What is the profit on a 10-gallon can of milk bought at \$2 per can, and sold at 8¢ per quart?
2. How much is received for a bushel of chestnuts sold at 5 cents a pint?
3. How many steps of 30 inches each are taken in going a block of 200 feet?
4. Change 250 pounds to the decimal of a ton.
5. At \$6 per ton what is the cost of 600 pounds of coal?
6. If 12 bottles of catsup contain  $2\frac{1}{4}$  gallons, how many pints does each contain?
7. What would a mile of fence cost at the rate of \$1.25 per rod?

*Written Problems*

1. What is the profit on 20 10-gallon cans of milk bought at 20 cents per gallon, if  $\frac{2}{10}$  of the milk is sold at 8 cents per quart and  $\frac{1}{10}$  of it is sold at 4 cents per quart?
2. A dealer buys  $2\frac{1}{2}$  bushels of chestnuts for \$1.80 per bushel, and sells them at 10 cents per quart; what is his profit?
3. How many steps at  $2\frac{1}{2}$  feet each are taken in going a mile?
4. Change 578 pounds to the decimal of a ton.
5. At \$6 per ton, what is the cost of 675 pounds of coal?
6. A man bought 45 gallons of catsup. How many bottles will hold it, if 12 bottles contain  $2\frac{1}{4}$  gallons?
7. Find the cost of a mile of fencing at the rate of 15 cents a yard.

# Operations with Compound Numbers—Addition and Multiplication

## Written Exercises

1. A tailor used 4 yards of cloth in making an overcoat, 3 yd. 6 in. for an inside coat, 2 yd. 2 ft. for the trousers, and 1 ft. 9 in. for the vest. How much cloth did he use ?

### PROCESS

<p>4 yd. 3 yd.      6 in. 2 yd. 2 ft.       1 ft. 9 in. <hr/>Ans. 10 yd. 1 ft. 3 in.</p>	<p>Write numbers in columns, the same denomination in the same vertical column. Beginning at the right, find the sum of the first column, which is 15 in. or 1 ft. 3 in. Write 3 in. and carry 1 ft. to the next column. The sum of this column, including the 1 ft. carried, is 4 ft. or 1 yd. 1 ft. Write 1 ft. and carry 1 yd.</p>
--	---

2. Add the following :

a. 6 yd. 2 in., 2 ft. 11 in., 4 yd. 2 ft., and 3 yd. 1 ft. 6 in.

b. 4 bu. 3 pk. 6 qt., 2 pk. 4 qt., 7 bu. 6 qt., and 3 pk. 4 qt.

c. 3 gal. 1 pt., 4 gal. 3 qt. 1 pt., 7 gal. 2 qt., and 1 gal. 1 qt. 1 pt.

3. When it requires 4 yd. 10 in. of cloth for a boy's suit, how much is required (a) for 5 suits ? (b) For 4 ?

Insert missing denomination : 4 yd. 0 ft. 10 in.

4. Find products :

a. 4 bu. 3 pk. 6 qt. by 3

b. 3 gal. 1 pt. by 5

c. 7 yd. 2 ft. 6 in. by 7

d. 2 bu. 3 qt. by 8

## Subtraction

*Written Exercises*

1. How much wire is left (a) when 24 yd. 8 in. are taken from a coil originally containing 40 yd. 1 ft.? (b) When 35 yd. 8 in. are taken from a coil containing 50 yd. 6 in.? (c) When 46 yd. 1 ft. 10 in. are taken from one containing 60 yd. 1 ft. 3 in.?

## PROCESS

$$\begin{array}{r} (a) \quad 40 \text{ yd. 1 ft.} \\ \quad 24 \text{ yd.} \quad 8 \text{ in.} \\ \hline \quad 16 \text{ yd.} \quad 4 \text{ in.} \end{array} \text{ Ans.}$$

(a) Think 8 in. and 4 in. (writing 4 in.) are 1 ft. Carrying 1 ft., think 1 ft. and 0 ft. are 1 ft., etc. *Test.*

$$\begin{array}{r} (b) \quad 50 \text{ yd.} \quad 6 \text{ in.} \\ \quad 35 \text{ yd.} \quad 8 \text{ in.} \\ \hline \quad 14 \text{ yd. 2 ft. 10 in.} \end{array} \text{ Ans.}$$

(b) Think 8 in. and 10 in. (writing 10 in.) are 1 ft. 6 in. Carrying 1 ft., think 1 ft. and 2 ft. (writing 2 ft.) are 1 yd.

$$\begin{array}{r} (c) \quad 60 \text{ yd. 1 ft. 3 in.} \\ \quad 46 \text{ yd. 1 ft. 10 in.} \\ \hline \quad 13 \text{ yd. 2 ft. 5 in.} \end{array} \text{ Ans.}$$

Carrying 1 yd., think 36 yd. and 14 yd. (writing 14 yd.) are 50 yd. *Test.*

(c) Think 10 in. and 5 in. (writing 5 in.) are 1 ft. 3 in. Carrying 1 ft., think 2 ft. and 2 ft. (writing 2 ft.) are 1 yd. 1 ft. Carrying 1 yd., think 47 yd. and 13 yd. (writing 13 yd.) are 60 yd. *Test.*

## 2. Subtract:

a. From 40 yd. take 24 yd. 8 in.

b. From 60 gal. take 18 gal. 3 qt. 1 pt.

c. From 84 bu. 2 pk. take 19 bu. 3 qt.

d. 48 yr. 6 mo. 7 da. — 9 yr. 8 mo. 9 da.

e. 72 yd. 1 ft. 4 in. — 57 yd. 2 ft. 8 in.

f. 16 wk. 4 da. 7 hr. — 8 wk. 5 da. 20 hr.

## Division — Abstract Divisors

*Preparatory Exercises*

1. Divide by 4:

a. 1 lb.      b. 2 lb.      c. 1 lb. 4 oz.      d. 5 lb. 4 oz.

2. Give quotients:

a.  $4 \overline{)8 \text{ lb. 4 oz.}}$       b.  $4 \overline{)9 \text{ lb.}}$       c.  $4 \overline{)9 \text{ lb. 8 oz.}}$ *Written Exercises*

1. What is the length of each piece, if 8 pieces are made from a bar of iron whose length is

(a) 48 yd. 2 ft.? (b) 49 yd. 4 in.? (c) 51 yd. 1 ft. 8 in.?

## PROCESS

(a)  $8 \overline{)48 \text{ yd. 2 ft.}}$ 

Ans. 6 yd. 3 in.

(b)  $8 \overline{)49 \text{ yd. 0 ft. 4 in.}}$ 

Ans. 6 yd. 5 in.

(c)  $8 \overline{)51 \text{ yd. 1 ft. 8 in.}}$ 

Ans. 6 yd. 1 ft. 4 in.

(a)  $48 \text{ yd.} \div 8 = 6 \text{ yd.}$  $2 \text{ ft.} \div 8 = 24 \text{ in.} \div 8 = 3 \text{ in.}$ (b)  $49 \text{ yd.} \div 8 = 1 \text{ yd.,}$  and remainder 1 yd., or 3 ft., or 36 in.

Add this to 4 in. which gives 40 in.

 $40 \text{ in.} \div 8 = 5 \text{ in.}$ (c)  $51 \text{ yd.} \div 8 = 6 \text{ yd.,}$  and remainder 3 yd., or 9 ft. Add thisto 1 ft. which gives 10 ft.  $10 \text{ ft.} \div 8 = 1 \text{ ft.}$  and remainder 2 ft., or 24 in. Add this to 8 in. which gives 32 in.  $32 \text{ in.} \div 8 = 4 \text{ in.}$ 

2. Find quotients:

a. 15 weeks  $\div$  9b. 13 wk. 6 da. 8 hr.  $\div$  4c. 27 yards  $\div$  6d. 87 yd. 1 ft. 6 in.  $\div$  5e. 49 bushels  $\div$  8f. 49 bu. 2 pk. 3 qt.  $\div$  6

3. Find answers:

a.  $\frac{2}{3}$  of 13 yearsb.  $\frac{3}{4}$  of 9 yr. 6 mo. 12 da.c.  $\frac{5}{8}$  of 25 yearsd.  $\frac{4}{5}$  of 2 yd. 1 ft. 6 in.e.  $\frac{3}{4}$  of 49 bushelsf.  $\frac{2}{3}$  of 7 bu. 2 pk. 6 qt.

## Denominate Divisors

*Preparatory Exercises*

1. Tell what part of a day is (a) 6 hours. (b) 8 hours. (c) 1 hour. (d) 30 minutes.

2. Divide 4 years (a) by 1 yr. (b) by 6 mo. (c) by 1 yr. 4 mo. (d) by 8 mo.

3. Divide 3 pounds (a) by 1 lb. (b) by 12 oz. (c) by 1 lb. 8 oz. (d) by 8 oz.

To divide one denominate number by another, make the divisor and the dividend of the *same denomination*.

It must be remembered that the quotient of a concrete divisor and a concrete dividend is *abstract*.

$$16 \text{ oz.} \div 4 \text{ oz.} = 4$$

$$24 \text{ yd.} \div 3 \text{ yd.} = 8$$

that is, 4 oz. is contained in 16 oz., 4 *times*, and 3 yd. is contained in 24 yd., 8 *times*.

*Written Exercises*

1. (a) When a suit contains 3 yd. 6 in. of cloth, how many suits will 15 yd. 2 ft. 6 in. make? (b) How many pairs of trousers will 21 yd. make if each takes 2 ft. 4 in.?

## PROCESS

$$(a) \ 15 \text{ yd. } 2 \text{ ft. } 6 \text{ in.} \div 3 \text{ yd. } 6 \text{ in.} = 570 \text{ in.} \div 114 \text{ in.} = 5.$$

*Ans.* 5 suits.

$$(b) \ 21 \text{ yd.} \div 2 \text{ ft. } 4 \text{ in.} = 756 \text{ in.} \div 28 \text{ in.} = 27. \quad \text{Ans. 27 pairs.}$$

Reduce the divisor and the dividend to the lowest denomination found in either.

2. Find quotients:

$$a. \ 10 \text{ yd. } 2 \text{ ft. } 8 \text{ in.} \quad b. \ 16 \text{ bu. } 2 \text{ pk.} + 1 \text{ pk. } 3 \text{ qt.}$$

$$c. \ 18 \text{ gal. } 3 \text{ qt.} + 2 \text{ qt. } 1 \text{ pt.} \quad d. \ 17 \text{ wk. } 1 \text{ da.} + 1 \text{ da. } 6 \text{ hr.}$$



*Sight Problems*

1. What day of the year is March 10, 1916?
2. How many hours and minutes are there in one tenth of a day?
3. How many nails can be made from a yard of wire when each nail requires  $2\frac{1}{4}$  inches of wire?
4. Find the number of half pints in a half bushel.
5. (a) What decimal of an hour is 39 minutes?  
(b) What fraction?
6. How many posts placed 6 feet apart are needed (a) for a fence 6 feet long? (b) For a fence 12 ft. long? (c) For a fence 120 ft. long?
7. A man worked from the morning of June 1 to the evening of June 5; how many days did he work?

*Written Problems*

1. What day of the year is Nov. 28, 1916?
2. How many hours and minutes are there in .65 of a day?
3. How many nails can be made from 4 yards of wire if each nail requires  $1\frac{1}{8}$  inches of wire?
4. Find the number of half pints in 1 bu. 1 pk. 1 qt. 1 pt.
5. (a) What decimal of an hour is 19 min. 30 sec.? (b) What fraction?
6. Including both end poles, how many telephone poles placed  $7\frac{1}{2}$  rods apart are required for a line 3 miles long?
7. At the rate of \$15 per month, how much does a man receive who begins work on the morning of Jan. 15 and stops after work on April 24?

## Percentage

*Preparatory Exercises*

1. Five baseball clubs, A, B, C, D, and E, play 20 games each. A won 16 games. (a) What fraction of its games did it win? (b) What decimal? (c) How many hundredths?

B won 14 games. (d) How many hundredths of its games did it win?

C won 12 games. (e) What decimal did it win? (f) How many hundredths?

D won 6 games. (g) How many hundredths of its games did D win?

E won 2 games. (h) How many hundredths of its games did E win?

In transactions of various kinds, the expression *per cent* is used instead of the word *hundredths*.

The sign of per cent is %.

3 % means 3 hundredths, or .03; 25 % means 25 hundredths, or .25.

2. Copy the following table. Insert the number of games won by each club, the number lost by each club, and the per cent of defeats.

CLUB	GAMES PLAYED	PER CENT	GAMES WON	GAMES LOST	PER CENT LOST
A	20	80 %			
B	20	70 %			
C	20	60 %			
D	20	30 %			
E	20	10 %			

*Written Exercises*

1. A drover spent (a) \$350 for sheep, which he sold at a profit of 6%; (b) \$437.50 for cows, which he sold at a profit of 8%; and (c) \$212 for hogs which he sold at a profit of 18%. What was his profit on each kind of stock?

PROCESS		
(a) \$350 × .06 \$21.00 <i>Ans.</i>	(b) \$437.50 × .08 \$35.0000 <i>Ans.</i>	(c) \$212 × .18 \$38.16 <i>Ans.</i>
Multiply by the per cent expressed as hundredths.		

## 2. Find

a. 3% of \$1125.    b. 12% of \$560.    c. 35% of 180 lb.

3. (a) A farmer sowed 180 bushels of wheat, of which  $2\frac{1}{4}\%$  failed to grow; how many bushels did not grow?  
 (b) Last year's crop was 2320 bushels; this year's crop is 205% of last year's. How many bushels are there in this year's crop?

PROCESS		
(a) 180 bu. × .02 $\frac{1}{4}$	(b) 2320 bu. 2.05	Write $2\frac{1}{4}\%$ and 205% as a two-place decimal in each case.

## 4. Find

a.  $3\frac{1}{2}\%$  of \$234.    b. 85% of 360 yd.    c.  $104\frac{1}{2}\%$  of 240 A.  
 d.  $2\frac{1}{4}\%$  of 64 bu.    e. 45% of 280 ft.    f.  $1\frac{1}{3}\%$  of \$176.  
 g. 60% of 250 lb.    h. 250% of 36 T.    i. 35% of 150 yd.

*Sight Exercises*

1. Change the following per cents to fractions:

- a. 2%    b. 10%    c.  $12\frac{1}{2}\%$     d. 20%    e.  $33\frac{1}{3}\%$   
 f. 4%    g. 25%    h.  $16\frac{2}{3}\%$     i. 50%    j. 5%

2. Change the following fractions to per cents:

- a.  $\frac{1}{2}$     b.  $\frac{1}{8}$     c.  $\frac{1}{4}$     d.  $\frac{1}{5}$     e.  $\frac{1}{6}$     f.  $\frac{1}{8}$     g.  $\frac{1}{10}$     h.  $\frac{1}{20}$   
 i.  $\frac{1}{25}$     j.  $\frac{1}{50}$     k.  $\frac{3}{4}$     l.  $\frac{2}{5}$     m.  $\frac{4}{5}$     n.  $\frac{3}{8}$     o.  $\frac{9}{10}$     p.  $\frac{3}{20}$

3. Using fractional equivalents for the per cents, give

- a.  $12\frac{1}{2}\%$  of 24 sheets.    b. 25% of 56 pages.    c.  $12\frac{1}{2}\%$  of \$488.  
 d.  $16\frac{2}{3}\%$  of 72 words.    e. 50% of 92 books.    f.  $33\frac{1}{3}\%$  of \$159.

*Written Exercises*

1. A man has a farm of 640 acres. How many acres are there in corn when (a)  $12\frac{1}{2}\%$  of the farm is in corn? (b)  $16\frac{2}{3}\%$ ? (c) 25%? (d)  $33\frac{1}{3}\%$ ? (e) 50%?

## PROCESS

$$\begin{array}{r} (a) \quad 640 \\ \times .12\frac{1}{2} \\ \hline \text{Ans. } 80 \text{ A.} \end{array}$$

$$\begin{array}{r} (b) \quad 640 \text{ A.} \\ \times .16\frac{2}{3} \\ \hline \text{Ans. } 106\frac{2}{3} \text{ A.} \end{array}$$

$$\begin{array}{r} (c) \quad 640 \text{ A.} \\ \times .25 \\ \hline \text{Ans. } 160 \text{ A.} \end{array}$$

$$\begin{array}{r} (d) \quad 640 \text{ A.} \\ \times .33\frac{1}{3} \\ \hline \text{Ans. } 213\frac{1}{3} \text{ A.} \end{array}$$

$$\begin{array}{r} (e) \quad 640 \text{ A.} \\ \times .50 \\ \hline \text{Ans. } 320 \text{ A.} \end{array}$$

Write the per cents in each case as a two-place decimal but multiply by the equivalent fraction;  $\frac{1}{2}$  in (a),  $\frac{1}{3}$  in (b),  $\frac{1}{4}$  in (c), etc.

2. Find

- a.  $12\frac{1}{2}\%$  of 264 lb.    b. 25% of \$369.    c.  $16\frac{2}{3}\%$  of 999 yd.  
 d.  $16\frac{2}{3}\%$  of \$459.    e. 50% of 378 A.    f.  $33\frac{1}{3}\%$  of 744 ft.  
 g.  $33\frac{1}{3}\%$  of 264 yd.    h. 25% of \$573.    i.  $12\frac{1}{2}\%$  of 368 qt.

*Sight Problems*

1. A boy was absent 10 % of the 190 regular school days. (a) How many days was he absent? (b) How many days did he attend?

2. A girl missed 4 % of 50 spelling words. (a) How many did she miss? (b) How many did she spell correctly?

3. A farmer lost 6 % of his 200 sheep by disease. How many sheep did he lose?

4. A merchant deducted 2 % of the amount of Mr. Jones's bill for prompt payment. If the original bill was \$60, how much was deducted?

5. To insure his house for \$1500, Mr. Johnson paid  $\frac{1}{4}$  of 1 % of this sum. How much did he pay?

6. For the use of \$1200 for a year Mrs. Brown paid 4 % of the sum borrowed. How much did she pay at the end of the year including the \$1200 borrowed?

7. A man whose house is valued at \$2400 pays  $\frac{3}{4}$  % of its value for taxes each year. How much are his yearly taxes?

8. A farmer has 1500 bushels of oats in the fall. How many bushels will he have in the spring if he loses 2 % of this quantity?

9. Last year's yield of hay on Mr. Ziegler's farm was 320 tons; this year's yield is 10 % more. What is this year's yield?

10. Of 50 pupils in a school 4 % are absent. How many are present?

11. In a year of 200 school days Mary was absent 2 days. (a) What fraction of the time was she absent? (b) What decimal? (c) What per cent?

**10.** In a test 20 spelling words were given. Make out a table showing the per cent a pupil should receive who had spelled 20 words, 19 words, etc.

[illegible]

## Interest

*Preparatory Exercises*

1. Mrs. Friedigkeit has \$200 in the savings bank. The bank pays her 4 % of this sum each year for the use of the money. How much does the bank give her yearly?

2. Mr. Beck buys a house for \$3000. As he has only \$2500 in cash, he borrows \$500 from a bank, paying the bank 5 % yearly for the use of the money. How much per year must he pay the bank for the use of the money?

*Money paid for the use of money is called interest.*

3. Mr. Wendell buys a \$100 machine on credit, agreeing to pay \$100 at the end of the year with 6 % interest. How much does he pay at the end of the year including the interest?

4. Give the interest (*a*) on \$100 for 1 year at 4 %.

b. On \$200 for a year at 5 %.

c. On \$300 for a year at 6 %.

d. On \$400 for a year at 7 %.

e. On \$250 for a year at 4 %.

5. At 4 % per year, give the interest :

a. On \$200 for 1 year.

b. On \$200 for 2 years.

c. On \$200 for 3 years.

d. On \$200 for  $1\frac{1}{2}$  years.

e. On \$200 for 1 year 6 months.

*Sight Exercises*

1. Give the interest (*a*) on \$200 for 3 years at 5%.

The interest for 1 year will be  $\$200 \times .05$ , or \$10; for three years it will be 3 times \$10, or \$30. *Ans.*

- b.* On \$300 for 2 years at 6%.  
*c.* On \$400 for 6 years at 3%.  
*d.* On \$100 for 5 years at 7%.  
*e.* On \$250 for 2 years at 4%.  
*f.* On \$100 for 1 year 6 months at 6%.  
*g.* On \$200 for 3 months at 4%.  
 2. At 4% per year, what will be the interest:  
*a.* On \$200 for 6 months?  
*b.* On \$300 for 4 months?  
*c.* On \$400 for 3 months?  
*d.* On \$300 for 2 months?  
*e.* On \$150 for 1 month?  
*f.* Find the interest on \$24 for 1 year at 5%.  
*g.* On \$36 for 1 year at 4%.  
*h.* On \$67 for 1 year at 3%.

*Written Exercises*

Find the yearly interest on:

1. \$286.50 at 4%

\$286.50

Multiply the principal by the rate, 4%, written as a decimal.  $\frac{.04}{Ans. \$11.4600}$

- |                              |                               |
|------------------------------|-------------------------------|
| 2. \$485 at 6%               | 3. \$168 at $3\frac{1}{4}\%$  |
| 4. \$375.40 at 5%            | 5. \$244 at $5\frac{1}{2}\%$  |
| 6. \$379 at 3%               | 7. \$890 at $7\frac{3}{10}\%$ |
| 8. \$486 at $4\frac{1}{2}\%$ | 9. \$63.75 at 4%              |



*Oral Problems*

1. I bought a house for \$4000, and sold it for 80 % of the cost. For what did I sell it?
2. A merchant whose income is \$2000 a year spends 75 % of it. How much does he save?
3. John has \$30 in the bank, Mary has  $16\frac{2}{3}$  % as much. How much has Mary?
4. If I buy goods for \$400 and sell them at a loss of 5 %, how much do I lose?
5. A farmer had 100 sheep and sold 20 % of them. How many did he sell?
6. Cloth shrinks 5 % of its length in sponging. What is the shrinkage of a piece which contained 40 yards before sponging?
7. In a school of 400, 60 % are boys. How many girls in the school?

*Written Problems*

1. A man receives a salary of \$1800 a year; he pays 15 % of it for board,  $8\frac{1}{3}$  % for clothing, and 16 % for other expenses. What are his yearly expenses?
2. My expenses during the month of April were \$185.68; my expenses in May were  $12\frac{1}{2}$  % less than in April. What were my expenses in May?
3. A lawyer collected 80 % of a debt of \$2360 and charged 5 % commission on the sum collected. How much did the creditor receive?
4. A house was insured for \$3600 at  $1\frac{1}{2}$  %. What was the cost of insurance?
5. What is the interest on \$550 for 2 years 6 months at 4 %?

# Fractions of a Dollar — Multiplication

## Written Exercises

1. What would be the cost of 860 bushels of potatoes at  $62\frac{1}{2}$  cents per bushel?

### PROCESS

$$\begin{array}{r} 215 \\ 860 \\ 1 \end{array} \times \frac{\$5}{\frac{8}{2}} = \frac{\$1075}{2} = \$537.50. \text{ Ans.}$$

Change  $62\frac{1}{2}\%$  to  $\frac{5}{8}$ . Multiply the latter by 860. Cancel. Write the answer in dollars and cents.

2. Find the cost of articles as follows :

a. 464 lb. at  $37\frac{1}{2}\%$     b. 253 bu. at 75¢    c. 184 gal. at  $62\frac{1}{2}\%$

3. I bought 486 bushels of timothy seed at  $\$2.37\frac{1}{2}$  per bushel. What was the amount of the bill?

### PROCESS

$$\begin{array}{r} 486 \\ \$2\frac{3}{8} \\ 8 \overline{)1458} \\ \underline{1821} \\ 972 \\ \$1154.25. \text{ Ans.} \end{array}$$

Change  $\$2.37\frac{1}{2}$  to  $\$2\frac{3}{8}$  and use it as the multiplier. Multiply 486 by  $\frac{3}{8}$  by multiplying 486 by 3 and dividing the product by 8. Change  $\frac{3}{8}$  in the result to  $\frac{1}{4}$ . Multiply 486 by 2. Combine the partial products, changing  $\frac{1}{4}$  to  $\$.25$ .

4. Multiply (a)  $\$2.37\frac{1}{2}$  by 28. (b)  $\$3.75$  by 34. (c)  $\$4.12\frac{1}{2}$  by 18.

## Sight Exercises

1. Multiply by 48 :

(a)  $12\frac{1}{2}\%$     (b)  $87\frac{1}{2}\%$     (c)  $37\frac{1}{2}\%$     (d)  $62\frac{1}{2}\%$

2. Give the cost of the following items :

a. 88 at  $\$1.12\frac{1}{2}$     b. 44 at  $\$1.25$     c. 16 at  $\$1.62\frac{1}{2}$   
d. 24 at  $\$1.16\frac{2}{3}$     e. 44 at  $\$1.50$     f. 18 at  $\$1.33\frac{1}{3}$

## Division

*Preparatory Exercises*

1. At 3 quarter dollars each, how many dolls can be bought (a) for six quarter dollars? (b) For 9 quarter dollars? (c) For  $\$2\frac{1}{4}$ ? (d) For  $\$3$ ?

2. Change each of the following to fourths and divide by 3 fourths :

(a)  $\frac{1}{4}$  (b)  $\frac{1}{2}$  (c) 1 (d)  $1\frac{1}{4}$  (e)  $1\frac{1}{2}$  (f) 2 (g)  $2\frac{1}{4}$  (h) 3

3. At 75 cents each, how many baseballs can be bought for (a)  $\$1.50$ ? (b)  $\$2.25$ ? (c)  $\$6$ ?

*Written Exercises*

1. How many yards can be bought for  $\$100$  (a) at 75 cents per yard? (b) At  $37\frac{1}{2}$  cents per yard?

## PROCESS

$$a. \$100 \div 75\text{¢} = \$100 \div \$\frac{3}{4} = 100 \times \frac{4}{3} = \frac{400}{3} = 133\frac{1}{3} \text{ (yd.)}$$

*Ans.*

$$b. \$100 \div 37\frac{1}{2}\text{¢} = \$100 \div \$\frac{3}{8} = 100 \times \frac{8}{3} = \frac{800}{3} = 266\frac{2}{3} \text{ (yd.)}$$

*Ans.*

NOTE. — When the divisor and the dividend are of the same denomination, the sign of the latter may be dropped :  $\$100 \div \$\frac{3}{4} = 100 \times \frac{4}{3}$ ;  $75 \text{ eighths} \div 3 \text{ eighths} = 75 \div 3$ .

2. Divide :

$$a. \$42 \text{ by } 37\frac{1}{2}\text{¢} \quad b. \$75 \text{ by } 62\frac{1}{2}\text{¢} \quad c. \$84 \text{ by } 75\text{¢}$$

$$d. \$91 \text{ by } 87\frac{1}{2}\text{¢} \quad e. \$57 \text{ by } 12\frac{1}{2}\text{¢} \quad f. \$99 \text{ by } 25\text{¢}$$

3. My bill for cloth at  $\$1.87\frac{1}{2}$  per yard came to  $\$71.25$ ; (a) how many yards did I buy? (b) How many bushels of timothy seed at  $\$2.37\frac{1}{2}$  a bushel would pay the bill?

PROCESS

$$a. \$71\frac{1}{4} \div \$1\frac{7}{8} = \frac{285}{4} \div \frac{7}{8} = \frac{285}{4} \times \frac{8}{7} = 38 \text{ (yd.)}. \text{ Ans.}$$

$$b. \$71\frac{1}{4} \div \$2\frac{3}{8} = \frac{285}{4} \div \frac{19}{8} = \frac{285}{4} \times \frac{8}{19} = 30 \text{ (bu.)}. \text{ Ans.}$$

4. Divide :

a. \$112.50 by \$1.87 $\frac{1}{2}$

b. \$103.50 by \$2.25

c. \$141.75 by \$3.37 $\frac{1}{2}$

d. \$272.25 by \$4.12 $\frac{1}{2}$

e. \$127.50 by \$3.75

f. \$110.25 by \$2.62 $\frac{1}{2}$

*Sight Exercises*

1. Give answers :

a. 9 eighths)27 eighths

b. 11 eighths)99 eighths

c. 3 halves)9 halves

2. Divide :

a.  $\frac{54}{8} \div \frac{9}{8}$ ;    b.  $\frac{44}{8} \div \frac{11}{8}$ ;    c.  $\frac{78}{8} \div \frac{13}{8}$ ;    d.  $\frac{60}{8} \div \frac{15}{8}$ .

3. Give quotients. Change the divisor and the dividend to 8ths, and disregard the equal denominators.

a. \$12.37 $\frac{1}{2}$   $\div$  \$1.12 $\frac{1}{2}$

b. \$12.37 $\frac{1}{2}$   $\div$  \$1.37 $\frac{1}{2}$

c. \$11.37 $\frac{1}{2}$   $\div$  \$1.62 $\frac{1}{2}$

d. \$11.25  $\div$  \$1.87 $\frac{1}{2}$

4. Divide :

a. \$11.25 by \$1.25    b. \$12.25  $\div$  \$1.75    c. \$20.25  $\div$  \$2.25

5. How many yards of cloth can be bought for \$21 when the price is (a) \$1.16 $\frac{2}{3}$  per yard? (b) \$2.33 $\frac{1}{3}$ ? (c) \$1.75? (d) \$1.50?

## Decimals

The denomination of a decimal is indicated by the number of decimal orders. A decimal of one order is read as *tenths*; of two orders, as *hundredths*; of three orders, as *thousandths*; of four orders, as *ten-thousandths*, etc.; as is shown in the following table :

Thousands	Hundreds	Tens	Ones	Decimal Point	Tenths	Hundredths	Thousandths	Ten-thousandths	Hundred-thousandths
1	2	3	4	.	5	6	7	8	9

## Reading Decimals

To read a decimal, ignore the decimal point and read it as the numerator of a common fraction, giving the name of its lowest order as the denominator.

.5 is read 5 tenths.

.03 is read as 3 hundredths.

.001 is read as 1 thousandth.

.234 is read as 234 thousandths.

.0203 is read as 203 ten-thousandths.

.12345 is read as 12345 hundred-thousandths.

Do not read a cipher or ciphers immediately following the decimal point; their presence being shown by the given denomination. Thus read .3, .03, .003, etc., *three* tenths, *three* hundredths, *three* thousandths, etc.

In reading mixed decimals, use the word "and" between the whole number and the decimal, omitting it in stating both the whole number and the decimal.

Thus, read 123.123, one hundred twenty-three *and* one hundred twenty-three thousandths.

## Writing Decimals

To write a decimal, write the given number, then prefix as many decimal ciphers as are required to make the right-hand figure of the necessary order, the whole being preceded by the decimal point.

Thus, in writing 27 hundred-thousandths, first write 27, then three decimal ciphers to locate 7, the right-hand figure, in the fifth decimal place, .00027.

*The value of a decimal is not changed by annexing or suppressing ciphers at the right of the decimal.*

Since  $\frac{300}{1000} = \frac{30}{100} = \frac{3}{10}$ ,  $.300 = .30 = .3$ .

*Sight Exercises*

Read the following :

a. 7.5	b. 3.075	c. 123.0467
d. 4.003	e. .125	f. .875
g. .004	h. 22.0008	i. 29.00009
j. 1.2345	k. .12345	l. 12.345
m. .0625	n. 4.1875	o. .0056
p. .22	q. .085	r. .16

In dictating numbers containing decimals to a person who is writing them in columns, for instance, announce the decimal when it is reached. Thus, read (a) 7, "point," 5; (d) 4, "point," 0, 0, 3; (g) "point," 0, 0, 4; using the letter "O" to indicate a cipher. In reading such a number as 100.007, it is of special importance to announce the decimal point to prevent the possibility of its being mistaken for 107 thousandths (.107).

## Addition and Subtraction

### Written Exercises

**1. Add:**

<i>a.</i> 123.45	<i>b.</i> 21.00001	<i>c.</i> 32.74	<i>d.</i> 5.086
6.087	16.54	195.	3.998
22.9406	314.8964	95.0075	101.3061
8.88	87.74	275.6	4.77235
204.0375	535.2	1.59	9.63
77.7	98.881	888.084	.0008
<u>987.54</u>	<u>250.004</u>	<u>129.1235</u>	<u>27.5</u>
<i>e.</i> 294.3817	<i>f.</i> 31.57842	<i>g.</i> 938.893	<i>h.</i> 113.46
46.206	130.5215	.07541	49.6097
1.66	.93084	158.13477	19.9
4.68431	175.21	46.0045	9.87
26.2	43.1509	1.29	.0086
.1567	.807	.3714	18.253
523.63089	6.54321	82.389	6.04

i.  $42.0985 + 3.73 + 61.29078 + .0897 + 12.3071 + 5.556$

**2. Add horizontally and vertically :**

<i>a.</i>	35.246	+	24.8469	+	9.85	+	.5136	=	?
<i>b.</i>	9.4895	+	47.235	+	.578	+	6.33	=	?
<i>c.</i>	51.898	+	8.7931	+	50.0992	+	.8874	=	?
<i>d.</i>	3.9078	+	.867	+	6.91	+	25.121	=	?
<i>e.</i>	24.693	+	97.64	+	.579	+	2.778	=	?
	?	+	?	+	?	+	?	=	?

**3. Subtract :**

<i>a.</i> 200.	<i>b.</i> 103.462	<i>c.</i> 530.045	<i>d.</i> 118.2
<u>− 20.08754</u>	<u>− 59.005357</u>	<u>− 75.0565</u>	<u>− 59.064</u>
<i>e.</i> 135.246	<i>f.</i> 874.612	<i>g.</i> 647.5	<i>h.</i> 317.06
<u>− 48.73593</u>	<u>− .623789</u>	<u>− 98.24687</u>	<u>− 78.3027</u>

**Multiplication of Decimals***Written Exercises*

1. Multiply  $\frac{3}{10}$  by  $\frac{3}{100}$ . How many ciphers are there in the denominator of the product? Write  $\frac{9}{1000}$  as a decimal. What is the product of .3 by .03?

2. Find the quantity of sheet steel in a strip 1.3 feet long, .07 feet wide.

**PROCESS**

1.3 (ft.)	The product of 13 tenths by 7 hundredths is 91 thousandths, which contains 3 decimal places. Prefix a decimal cipher.
.07 (ft.)	
<u>.091</u> (sq. ft.)	

3. Multiply :

- |                       |                       |                       |
|-----------------------|-----------------------|-----------------------|
| a. $8.94 \times .69$  | b. $9.752 \times 1.7$ | c. $4.36 \times .023$ |
| d. $36.37 \times 9.5$ | e. $65.73 \times .37$ | f. $.657 \times .034$ |

4. Find the area of a strip of land 1.05 mi. long, .026 mi. wide.

**PROCESS**

1.05 (mi.)	Prefix a decimal cipher to make the necessary five places in the product, then reject the terminal cipher.
.026 (mi.)	
<u>630</u>	
210	
<u>.02730</u>	Thus, the product of 1 and 5 hundredths by 26 thousandths is 2730 hundred-thousandths, which is reducible to 273 ten-thousandths.
Ans. .0273 (sq. mi.)	

5. Multiply :

- |                        |                        |                         |
|------------------------|------------------------|-------------------------|
| a. $6.5 \times 2.834$  | b. $.315 \times .26$   | c. $84.25 \times 7.04$  |
| d. $8.432 \times 4.25$ | e. $17.835 \times .72$ | f. $484.48 \times .025$ |



## Division of Decimals

## Integral Divisors

*Sight Exercises*

Divide:

a.  $2 \overline{) .04}$

b.  $5 \overline{) .10}$

c.  $8 \overline{) .40}$

d.  $11 \overline{) .66}$

e.  $3 \overline{) .006}$

f.  $6 \overline{) .18}$

g.  $9 \overline{) .045}$

h.  $12 \overline{) .60}$

i.  $4 \overline{) .0088}$

j.  $7 \overline{) .021}$

k.  $10 \overline{) .1230}$

l.  $13 \overline{) .039}$

m.  $2 \overline{) 8.04}$

n.  $5 \overline{) 10.1}$

o.  $8 \overline{) 8.4}$

p.  $11 \overline{) 22.66}$

*Written Exercises*

1. A train traveled 21.68 miles in 32 minutes. What decimal of a mile did it travel per minute?

*Ans.* .6 etc. (mi.)

$32 \overline{) 21.68 \text{ mi.}}$

$\underline{19 \ 2}$

$\underline{2 \ 48}$

etc.

## PROCESS

Write the decimal point in the quotient above the decimal point in the dividend. Continue the division by bringing down ciphers, but do not write them in the dividend.

Complete the work.

2. Complete the following:

a. .08 etc.

$25 \overline{) 2.14}$

$\underline{2 \ 00}$

$\underline{140}$

b. .005 etc.

$25 \overline{) .146}$

$\underline{125}$

$\underline{210}$

3. Find quotients:

a.  $.292 \div 25$

b.  $2.92 \div 125$

c.  $324 \div 32$

d.  $.192 \div 16$

e.  $.72 \div 48$

f.  $24 \div 64$

g.  $2.92 \div 5$

h.  $3.6 \div 75$

i.  $36 \div 1875$

## Divisors ending in Ciphers

*Written Exercises*

1. Divide (a) 12 by 80. (b) 7.2 by 600. (c) 3 by 5000.

## PROCESS

$$(a) \begin{array}{r} 8\cancel{0})\underline{1.2/} \\ .15 \end{array}$$

$$(b) \begin{array}{r} 6\cancel{00})\underline{.07/2} \\ .012 \end{array}$$

$$(c) \begin{array}{r} 5\cancel{000})\underline{.003/} \\ .0006 \end{array}$$

• Cancel the final cipher or ciphers in the divisor, and move the decimal point in the dividend as many places to the left as there are canceled ciphers in the divisor.

Divide the dividend as changed by the remaining figures of the divisor.

2. Divide :

$$a. 163.53 \div 900 \quad b. 914.8 \div 1600 \quad c. 90.09 \div 180$$

$$d. 19.591 \div 260 \quad e. 278.35 \div 5000 \quad f. 17.1 \div 240$$

$$g. 131.78 \div 400 \quad h. 1.1256 \div 4200 \quad i. 3.89 \div 250$$

## Decimal Divisors

*Preparatory Exercises*

1. What are (a) 4 times 2 pounds? (b) 4 times \$3?  
(c) 4 times 2 tenths? (d) 4 times .2?

2. How many times are (a) 2 pounds contained in 8 pounds? (b) \$2 in \$8? (c) 2 thirds in 8 thirds?  
(d) 2 tenths in 8 tenths? (e) .2 in .8?

3. Give quotients:

$$a. 2 \text{ lb. } \overline{)8 \text{ lb.}} \quad b. \$2 \overline{)\$8} \quad c. \frac{2}{3} \overline{)\frac{8}{3}} \quad d. .2 \overline{).8}$$

4. At 2 cents each, how many tops can be bought  
(a) for 50 cents? (b) for \$1? (c) for \$1.50? (d) for \$2?

Divide (a) .4048 by 6.4. (b) 91.08 by .24. (c) 1819.98 by .036.

In (a) multiply the divisor and the dividend by 10, in (b) by 100, and in (c) by 1000.

*The quotient is unchanged when the divisor and the dividend are multiplied or divided by the same number.*

#### PROCESS

(a) 6.4).4048	(b) .24)91.08	(c) .036)1819.98
.06325 <i>Ans.</i>	379.5 <i>Ans.</i>	50555 <i>Ans.</i>
$\begin{array}{r} 64 \overline{)4.048} \\ 3.84 \phantom{00} \\ \hline 208 \phantom{00} \\ 192 \phantom{00} \\ \hline 160 \phantom{00} \\ 128 \phantom{00} \\ \hline 320 \phantom{00} \\ 320 \phantom{00} \\ \hline \end{array}$	$\begin{array}{r} 24 \overline{)9108.} \\ 72 \phantom{00} \\ \hline 190 \phantom{00} \\ 168 \phantom{00} \\ \hline 228 \phantom{00} \\ 216 \phantom{00} \\ \hline 120 \phantom{00} \\ 120 \phantom{00} \\ \hline \end{array}$	$\begin{array}{r} 36 \overline{)1819980.} \\ 180 \phantom{00} \\ \hline 199 \phantom{00} \\ 180 \phantom{00} \\ \hline 198 \phantom{00} \\ 180 \phantom{00} \\ \hline 180 \phantom{00} \\ 180 \phantom{00} \\ \hline \end{array}$

In (a) change the divisor to a whole number by moving the decimal point one place to the right, and make a similar change in the dividend. In (b) move the decimal point two places to the right in both. In (c) move the decimal point three places to the right, which requires the annexation of a cipher to the dividend.

The changed divisors and dividends may be rewritten as shown above. The decimal point in the quotient is written over the decimal point in the changed dividend.

*In dividing by a decimal change the divisor to a whole number by removing the decimal point, and move the decimal point in the dividend a corresponding number of places to the right.*

*Written Exercises*

## 1. Divide :

- a.  $23.541 \div .6$       b.  $637.94 \div .08$       c.  $.18018 \div .007$   
 d.  $3.7598 \div .4$       e.  $767.94 \div 1.2$       f.  $.43043 \div 1.1$   
 g.  $5.2317 \div .09$       h.  $831.74 \div .5$       i.  $1.8936 \div .24$

## 2. Divide (a) 18.3 by .028 (b) 1.83 by .27.

PROCESS	
<i>Ans.</i> $653.571^+$	$6.77.$ <i>Ans.</i> $6.\dot{7}$
$\begin{array}{r} /028 \overline{)18/300.} \\ 168 \\ \underline{150} \\ 140 \\ \underline{100} \\ 84 \\ \underline{160} \\ 140 \\ \underline{200} \\ 196 \\ \underline{40} \\ 28 \\ \underline{12} \end{array}$	$\begin{array}{r} /27 \overline{)1/83.} \\ 162 \\ \underline{210} \\ 189 \\ \underline{210} \end{array}$

In (a) the plus sign after the last quotient figure shows that there is a remainder and that the next quotient figure is less than 5. In (b) each partial remainder after the first is 21, which produces successive quotient figures of 7, 7, 7, etc. This is indicated by a period written over the first 7, as shown above. The answer may also be written 6.778-, the last quotient figure being increased by 1 and a minus sign written after it, which means that it is greater than 6.775, and less than 6.778.

In the following examples, give only three significant figures after the decimal point; that is, three figures other than ciphers. When the fourth figure is 5 or more, increase the preceding figure by 1 and write a minus sign after it; when the fourth figure is less than 5, place a plus sign after the third figure.

## 3. Find quotients :

- a.  $124.054 \div 23.785$       b.  $2.3452 \div 245.31$   
 c.  $11.224 \div 2.576$       d.  $83.423 \div 31.586$

# Reductions — Decimals to Common Fractions

## Written Exercises

1. Change to common fractions (a) .051; (b) .64; (c) .0075.

### PROCESS

$$\begin{array}{ll} a. .051 = \frac{51}{1000}. & \text{Ans.} \quad b. .64 = \frac{64}{100} = \frac{16}{25}. \quad \text{Ans.} \\ c. .0075 = \frac{75}{10000} = \frac{3}{400}. & \text{Ans.} \end{array}$$

Rewrite each decimal in the form of a common fraction. Since in (a) the numerator ends in an odd number other than 5, it is expressed in lowest terms. In (b) divide both terms by 4; in (c) by 25.

2. Express as common fractions in lowest terms :

a. .004	b. .125	c. .375	d. .0375
e. .0004	f. .0625	g. .242	h. .048
i. .1875	j. .085	k. .0056	l. .036
m. .1648	n. .0256	o. .96	p. .096

## Common Fractions to Decimals

Since the fraction  $\frac{3}{4}$  indicates that 3 is divided by 4, it is changed to a decimal by performing the division:

$$\begin{array}{r} 4 \overline{)3.00} \\ \underline{.75} \end{array} \quad \text{Dividing 300 hundredths by 4 gives a quotient of 75 hundredths.} \quad \text{Ans.}$$

To change  $\frac{5}{8}$  to a decimal, the dividend is made 5000 thousandths, which gives a quotient of  $\frac{625}{1000}$ .

In practice, omit the ciphers. Place a decimal point after the last figure of the numerator, and one in the quotient when it is reached in the dividend, prefixing decimal ciphers in the quotient when required.

*Written Exercises*

1. Change (a)  $\frac{3}{18}$ ; (b)  $\frac{7}{80}$  to decimals.

$$a. \begin{array}{r} 16 \overline{)3.} \\ \underline{.1875.} \end{array} \text{ Ans.}$$

$$b. \begin{array}{r} 80 \overline{).74} \\ \underline{.0875.} \end{array} \text{ Ans.}$$

2. Change to decimals:

$$\begin{array}{lllll} a. \frac{1}{18} & b. \frac{1}{125} & c. \frac{9}{84} & d. \frac{8}{80} & e. \frac{81}{125} \\ f. \frac{5}{18} & g. \frac{3}{125} & h. \frac{1}{32} & i. \frac{11}{80} & j. \frac{17}{250} \end{array}$$

*Sight Exercises*

Change to common fractions:

$$\begin{array}{lllll} a. .24 & b. .375 & c. .075 & d. .15 & e. .05 \\ f. .6 & g. .625 & h. .84 & i. .045 & j. .005 \end{array}$$

**Compound Fractions and Complex Fractions**

An expression consisting of a fraction of a fraction is called a *compound fraction*; such as

$$\frac{3}{4} \text{ of } \frac{9}{10}, \frac{7}{8} \text{ of } 3\frac{3}{4}, \text{ etc.},$$

A fractional expression containing a fraction in the numerator, or in the denominator, or in both, is called a *complex fraction*; such as

$$\frac{2\frac{1}{2}}{3}, \frac{4}{3\frac{1}{8}}, \frac{5\frac{1}{2}}{6\frac{2}{3}}, \text{ etc.}$$

To simplify a compound or a complex fraction perform the indicated operation.

*Sight Exercises*

1. Simplify the following:

$$\begin{array}{lll} a. \frac{2}{3} \text{ of } \frac{9}{18} & b. \frac{3}{4} \text{ of } 1\frac{1}{2} & c. \frac{4}{7} \text{ of } 3\frac{1}{2} \\ d. \frac{3}{7} \text{ of } \frac{5}{12} & e. \frac{2}{5} \text{ of } 3\frac{3}{4} & f. \frac{5}{6} \text{ of } 1\frac{1}{5} \end{array}$$

## Reducing Complex Decimals

To change a complex decimal, write it as a complex fraction, and simplify the latter.

*Written Exercises*

1. Change (a)  $.8\frac{1}{3}$ ; (b)  $.46\frac{2}{3}$  to common fractions.

## PROCESS

$$(a) \quad .8\frac{1}{3} = \frac{8\frac{1}{3}}{10} = \frac{\overset{5}{25}}{3} \times \frac{1}{\underset{2}{10}} = \frac{5}{6} \text{ Ans.}$$

$$(b) \quad .46\frac{2}{3} = \frac{46\frac{2}{3}}{100} = \frac{\overset{7}{140}}{3} \times \frac{1}{\underset{5}{100}} = \frac{7}{15} \text{ Ans.}$$

2. Reduce to common fractions, lowest terms :

a.  $.3\frac{1}{3}$

b.  $.83\frac{1}{3}$

c.  $.642\frac{8}{7}$

d.  $.23\frac{1}{3}$

e.  $.2\frac{8}{7}$

f.  $.57\frac{1}{7}$

g.  $.812\frac{1}{2}$

h.  $.91\frac{2}{3}$

## Decimal Drills

Change a decimal multiplier or divisor to a common fraction, when it will simplify the work.

1. Give products :

a.  $60 \times .3$

b.  $.25 \times 48$

c.  $24 \times .125$

d.  $125 \times .24$

e.  $25 \times .4$

f.  $.75 \times 36$

g.  $48 \times .375$

h.  $375 \times .48$

i.  $48 \times .5$

j.  $.12 \times 25$

k.  $32 \times .625$

l.  $625 \times .64$

2. Give quotients :

a.  $36 \div .3$

b.  $42 \div .25$

c.  $21 \div .125$

d.  $21 \div 1.25$

e.  $24 \div .4$

f.  $24 \div .75$

g.  $24 \div .375$

h.  $24 \div 3.75$

i.  $32 \div .5$

j.  $36 \div .12$

k.  $35 \div .625$

l.  $35 \div 6.25$

*Sight Problems*

1. If a drover sells 24 cattle of his herd of 64, (a) what fraction of the herd does he sell? (b) What decimal of the herd? (c) How many hundredths?

2. John is 12 years old, James is 16 years old. (a) John's age is what decimal of James's? (b) James's age is what fraction of John's?

3. If I buy a horse for \$160 and sell it for \$200, (a) what decimal of the cost is the profit? (b) What fraction of the selling price is the profit?

4. A kilogram is a weight of 2.2046 pounds. How many pounds are there in 1000 kilograms?

5. A kilometer is 1000 meters of 39.37 inches each; how many inches are there in a kilometer?

6. Find the cost of an acre of land at the rate of \$40 for .2 acre.

7. The owner of a flock of 120 sheep sold 90 of them. (a) What fraction of the flock did he sell? (b) What decimal?

8. If a man spends .67 of his money, what decimal of it has he left?

9. After spending .67 of his money a boy has 66 cents left; how much money had he at first?

10. If I buy a cow for \$40 and sell it for \$50, my profit is what decimal (a) of the cost of the cow? (b) Of the price received for it?

11. (a) What fraction of 25 is 15? (b) What decimal of 25 is 15? (c) What fraction of 15 is 25? (d) How many hundredths of 25 is 15?

12. If 15 hundredths of a number is 60, what is the number?



*Written Problems*

1. Mr. Ullo has three farms, the first containing 240.8125 acres, the second containing 37.5 acres more than the first, and the third containing 65.44 acres more than the second. How many acres are there (a) in the second farm? (b) In the third? (c) In the three farms?

2. At 62.5 bushels to the acre, how many bushels of corn will be raised on 324 acres?

3. The perimeter of a square field is 326.4 rods. Find the area (a) in square rods; (b) in acres, at 160 square rods to the acre.

4. How many bales of 93.75 pounds each will weigh 5.4375 tons?

5. (a) Find in cubic yards the capacity of a bin 18.75 ft. long, 13.5 ft. wide, 11.2 ft. deep. (b) How many bushels of grain would it hold at .8 bu. to the cubic foot?

6. A train goes 851 miles in 18.4 hours. (a) How many miles per hour is its average rate? (b) How long would it require to go 1110 miles at the same speed?

7. From a plot 60.625 rods long and 53.5 rods wide a piece is sold 24.25 rods long and 21.4 rods wide. What decimal part of the original piece (a) is sold? (b) Is left?

8. If .75 of M's farm contains 94.35 acres, how many acres are there in the farm?

9. The total length of three sections of a railroad is 100 miles; one section is 43.65 miles long, another is 22.375 miles long; how long is the third section?

10. How much is the cost of an acre of land at the rate of \$29 for .125 acre?

11. After withdrawing from bank 67 hundredths of his money a man has still in bank \$132. How many dollars had he originally in the bank?

**Areas of Right Triangles***Preparatory Exercises*

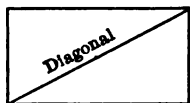
1. How many square yards are there in a rectangle 48 yards long, 25 yards wide?

2. When the foregoing rectangle is divided into two equal parts by a line extending from one corner to an opposite one, how many square yards are there in each part?

3. When the sides of a rectangular sheet of iron measure 10 and 12 inches, respectively, (a) how many square inches does it contain? (b) What is the area of each of the two triangles into which it is divided by the diagonal?

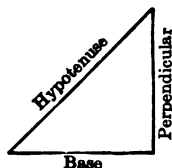
4. What is the area of each piece of ground into which a rectangular plot 30 inches by 20 inches is divided by a diagonal?

A figure of four sides is called a *quadrilateral*. When a quadrilateral has four square corners, it is called a *rectangle*. When the sides of a rectangle are equal it is called a *square*.



A line extending from one corner of a quadrilateral to the opposite corner is called a *diagonal*. The diagonal of a rectangle divides the latter into two triangles, called *right triangles*, each containing a square corner.

The side of a right triangle corresponding to the diagonal of the rectangle, is the longest; it is called the *hypotenuse*. One of the other sides is called the *base*, and the remaining side is called the *perpendicular*; these two sides correspond with the length and the width of a rectangle, and are called the *dimensions* of the triangle.



*Written Exercises*

1. Find the number of square yards in a piece of ground in the form of a right triangle when its base measures 21 yd. 1 ft. and its perpendicular 16 yd. 1 ft. 6 in.

## PROCESS

$$\frac{1}{2} \text{ of } 21\frac{1}{3} \text{ (yd.)} \times 16\frac{1}{2} \text{ (yd.)} = \frac{1}{2} \times \frac{\overset{16}{\cancel{32}} \overset{11}{\cancel{64}}}{\underset{3}{\cancel{3}}} \times \frac{\overset{11}{\cancel{33}}}{\underset{2}{\cancel{2}}} = 176 \text{ (sq. yd.)}.$$

*Ans.*

Write each dimension as yards and a fraction. Change each mixed number to an improper fraction. Indicate the continued product of  $\frac{1}{2}$  and the two improper fractions. Cancel.

2. How many square feet are there in a right triangle whose dimensions are 18 ft. 9 in. and 13 ft. 4 in. ?

$$\text{Number of square feet} = \frac{1}{2} \text{ of } 18\frac{3}{4} \times 13\frac{1}{2}.$$

Change to improper fractions and cancel.

3. Find the number of acres in a rectangular field 62.5 rods long, 38.4 rods wide.

As there is no linear measure corresponding to the acre, the area in square rods is divided by 160.

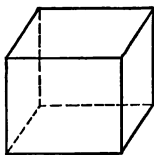
$$\text{Area in acres} = \frac{62.5 \times 38.4}{160}. \quad \text{Cancel.}$$

4. How many square rods are there in a right triangle having a base of 33 yards and a perpendicular of 36 yards 2 feet ?

5. Find the area in acres and the perimeter in rods of a right triangle whose base measures 45 rods and whose perpendicular measures 24 rods, the hypotenuse measuring 51 rods. What fraction of a mile is the perimeter ?

**Rectangular Solids**

A *rectangular prism* is a solid having six rectangular faces. When all the faces are square, the solid is called a *cube*. When the ends are square and the four remaining faces are rectangles, the solid is called a *square prism*.



A *surface* has two dimensions, length and breadth ; a *solid* has three : length, breadth, and thickness.

**Volume of Rectangular Solids**

*The volume of a rectangular prism is the continued product of the length by the breadth by the thickness.*

**Sight Problems**

1. Find the volume of a rectangular block of granite 3 ft. high, 4 ft. long, 2 ft. 6 in. wide.

$$\text{Number of cubic feet} = 3 \times 4 \times 2\frac{1}{2}$$

2. Find the surface of the outside of a box having

- a. 2 faces, each 3 ft. by 4 ft.
- b. 2 faces, each 4 ft. by 2 ft. 6 in.
- c. 2 faces, each 3 ft. by 2 ft. 6 in.

3. How many cubic feet are there in a pile of wood 8 ft. long, 4 ft. wide, and 4 ft. high ?

4. At  $7\frac{1}{2}$  gallons to the cubic foot, how many gallons would a tank hold whose dimensions are 2 ft.  $\times$  2 ft.  $\times$  2 ft. ?

*Written Problems*

1. At 231 cu. in. to the gallon, how many gallons are there in a cubic foot? (a) Give the answer as a mixed decimal. (b) As a mixed number, expressing the fraction in lowest terms.

2. At  $7\frac{1}{2}$  gallons to the cubic foot, find the capacity in gallons of a tank 11 ft. long, 3 ft. wide, 7 ft. high.

3. At 231 cubic inches to the gallon, how many gallons will a tank contain whose dimensions are 11 ft. by 3 ft. by 7 ft.?

*Indicate the number of inches in each dimension and divide by 231.*

$$\text{Cancel.} \quad \frac{11 \times 12 \times 3 \times 12 \times 7 \times 12}{231}$$

4. A bushel contains 2150.4 cu. in. How many cubic feet are there in a bushel? Find answer (a) as a mixed decimal (three places). (b) As a mixed number.

5. Change  $\frac{4224}{17280}$  to lowest terms.

6. At  $1\frac{1}{4}$  cubic feet to the bushel, what decimal of a bushel is a cubic foot?

7. Find the capacity in bushels of a bin 8 ft. 3 in. by 4 ft. 8 in. by 3 ft. 9 in., at  $\frac{4}{5}$  bu. to the cu. ft.

8. At  $\frac{4}{5}$  bushel to the cubic foot, find the number of bushels of grain in a bin  $2\frac{3}{4}$  feet square, the depth of the grain being  $1\frac{3}{4}$  feet.

$$2\frac{3}{4} \times 2\frac{3}{4} \times 1\frac{3}{4} \times \frac{4}{5} \text{ bu.}$$

Observe that 1 cubic foot is nearly  $7\frac{1}{2}$  gallons and nearly  $\frac{4}{5}$  bushel.

9. A farmer built a silo 15 feet square, inside measurement, and 30 feet high. (a) Find its capacity in cubic feet. (b) At 50 lb. to the cubic foot, how many tons of feed will it hold?

10. At \$6 per cubic foot, what is the cost of a granite column 18 inches square and 9 feet high?

Make rough diagrams when necessary.

11. Find the number of square yards in the area of a right triangle having a base of 13 yd. 1 ft. and a perpendicular of 19 yd. 1 ft. 6 in.

12. A field in the form of a right triangle contains an acre. If the perpendicular is 24 rods, what is the base?

13. A room is 18 ft. long, 15 ft. wide, and 9 ft. high. How many square yards of surface are there in the walls and the ceiling?

14. The rug on a parlor floor 18 ft. by 15 ft. leaves uncovered a strip  $1\frac{1}{2}$  ft. wide around the sides of the room. (a) What are the dimensions of the rug? (b) How many square yards does it contain? (c) How many square yards are there in the uncovered portion of the floor? (Make a diagram.)

15. How many square yards of carpet are there in a roll 36 yards long, 27 inches wide?

16. How many square yards are there in a strip of grass 30 yards long, 2 feet wide?

17. If a field is 10 yards wide, how many times would a person go back and forth in cutting the grass with a machine that cuts a strip 2 feet wide?

18. How many strips of carpet 27 inches wide will cover a floor 9 yards wide? (Diagram.)

19. (a) How many square feet are there in a lawn 20 yards long, 10 yards wide? (b) If the steps taken in turning are not counted, how many feet does a boy walk in cutting the grass with a lawn-mower that cuts a strip 2 feet wide?

20. How many cords of wood are there in a pile 16 feet long, 4 feet wide, and 8 feet high?

## Reviews — Addition and Subtraction

*Oral Drills*

To add 647 and 24, think 667 ( $6 \times 7 + 20$ ), 671 (adding 4).

1. Add. Give sums :

- a.  $247 + 48$    b.  $128 + 126$    c.  $845 + 260$    d.  $55 + 135$   
e.  $364 + 29$    f.  $115 + 158$    g.  $728 + 361$    h.  $44 + 149$   
i.  $438 + 37$    j.  $154 + 119$    k.  $633 + 148$    l.  $33 + 127$   
m.  $527 + 53$    n.  $139 + 137$    o.  $554 + 219$    p.  $22 + 118$

To diminish 384 by 36, think 354 ( $384 - 30$ ), 348 ( $-6$ ).

2. Give remainders :

- a.  $195 - 18$    b.  $153 - 119$    c.  $930 - 160$    d.  $592 - 68$   
e.  $283 - 27$    f.  $241 - 227$    g.  $844 - 180$    h.  $483 - 59$   
i.  $374 - 36$    j.  $362 - 338$    k.  $768 - 190$    l.  $371 - 47$   
m.  $461 - 44$    n.  $476 - 418$    o.  $651 - 170$    p.  $264 - 36$

*Sight Problems*

1. What is the profit on furniture bought for \$148 and sold for \$175?

2. If a man has 143 acres of land, how much will he have after buying 47 acres more?

3. A boy picked 119 quarts of strawberries and his sister picked 79 quarts. How many quarts did both pick?

4. A dealer sold 128 tons of coal on Monday and 68 tons on Tuesday. How many tons did he sell in the two days?

5. What did Mr. Jones pay for a lot if he lost \$49 by selling it for \$126?

6. A man's earnings are \$150 per month. He spends \$116. How much does he save?

*Written Exercises*

1. A farmer sold five loads of apples at 90 cents per bushel of 50 pounds. Fill out the following

STATEMENT

GROSS WEIGHT	WEIGHT OF WAGON	NET WEIGHT	BUSHEL	PRICE	VALUE
3380	1230	2150	43	\$.90	\$38.70
3425	1225				
3417	1267				
3448	1198				
3319	1219				
Totals (a)	(b)	(c)	(d)	\$.90	(e)

2. Mr. Brown's receipts from sales of produce during 1914 and 1915, respectively, are given in the following table:

PRODUCE	SALES, 1914	SALES, 1915	INCREASE, 1915 OVER 1914	DECREASE, 1915 FROM 1914
Grain . . .	\$1876.50	\$2134.91	(c)	(d)
Vegetables .	347.22	298.74		
Poultry . .	96.45	134.80	(c)	
Hay . . .	518.34	345.70		
Eggs . . .	237.18	416.00	(c)	
Milk . . .	354.60	362.76	(c)	
Totals . .	(a)	(b)	(f)	

Copy the foregoing table and insert (a) the total sales for 1914, (b) the total sales for 1915, (c) the several increases in 1914, (d) the decreases, and (f) the net increase.



## Adding Mixed Numbers

*Written Exercises*

1. A piece of work required the labor of four men for  $3\frac{7}{15}$  days,  $5\frac{2}{20}$  days,  $2\frac{1}{18}$  days, and  $1\frac{5}{9}$  days, respectively. How many days of labor were required?

## LEAST COMMON MULTIPLE

$$2)15 - 20 - 18 - 9$$

$$3)15 - 10 - 9$$

$$\quad 5 - 10 - 3$$

$$2 \times 3 \times 10 \times 3 = 180 \text{ (L. C. M.)}$$

After writing the denominators in a row cancel 9, which is a factor of 18. Divide the remaining numbers by 2 bringing down 15.

Divide the three quotients by 3 (the smallest factor of two of them) and bring down 10. Cancel 5, which is a factor of 10. Since 10 and 3 have no common factor, multiply together these two numbers and the two divisors, which gives 180 as the least common multiple of the denominators.

2. Find sums:

$$\begin{array}{r} a. \quad 9\frac{2}{7} \\ 15\frac{3}{8} \\ 7\frac{5}{12} \\ \hline \end{array}$$

$$\begin{array}{r} b. \quad 16\frac{5}{8} \\ 20\frac{3}{8} \\ 8\frac{7}{20} \\ \hline \end{array}$$

$$\begin{array}{r} c. \quad 18\frac{5}{18} \\ 4\frac{1}{15} \\ 6\frac{3}{20} \\ \hline \end{array}$$

$$\begin{array}{r} d. \quad 33\frac{7}{8} \\ 6\frac{7}{12} \\ 40\frac{8}{15} \\ \hline \end{array}$$

$$\begin{array}{r} e. \quad 16\frac{3}{10} \\ 5\frac{1}{9} \\ 12\frac{2}{4} \\ 8\frac{7}{12} \\ \hline \end{array}$$

$$\begin{array}{r} f. \quad 1\frac{4}{9} \\ 42\frac{7}{12} \\ 3\frac{1}{6} \\ 19\frac{2}{15} \\ \hline \end{array}$$

$$\begin{array}{r} g. \quad 7\frac{3}{14} \\ 8\frac{2}{3} \\ 20\frac{1}{9} \\ 4\frac{5}{7} \\ \hline \end{array}$$

$$\begin{array}{r} h. \quad 22\frac{3}{10} \\ 6\frac{2}{9} \\ 17\frac{1}{6} \\ 20\frac{5}{12} \\ \hline \end{array}$$

$$\begin{array}{r} i. \quad 25\frac{5}{7} \\ 6\frac{1}{8} \\ 22\frac{1}{12} \\ 3\frac{3}{14} \\ 5\frac{5}{24} \\ \hline \end{array}$$

$$\begin{array}{r} j. \quad 15\frac{1}{2} \\ 5\frac{2}{3} \\ 30\frac{1}{4} \\ 6\frac{1}{6} \\ 28\frac{2}{7} \\ \hline \end{array}$$

$$\begin{array}{r} k. \quad 3\frac{1}{2} \\ 14\frac{2}{9} \\ 8\frac{2}{7} \\ 9\frac{3}{10} \\ 52\frac{1}{4} \\ \hline \end{array}$$

$$\begin{array}{r} l. \quad 14\frac{2}{3} \\ 6\frac{2}{5} \\ 18\frac{3}{4} \\ 41\frac{2}{7} \\ 8\frac{7}{15} \\ \hline \end{array}$$

### Subtracting Mixed Numbers

3. Find remainders:

$$\begin{array}{r} a. \ 25\frac{3}{7} \\ - 6\frac{5}{8} \\ \hline \end{array}$$

$$\begin{array}{r} b. \ 34\frac{2}{15} \\ - 17\frac{5}{8} \\ \hline \end{array}$$

$$\begin{array}{r} c. \ 42\frac{1}{2} \\ - 5\frac{7}{9} \\ \hline \end{array}$$

$$\begin{array}{r} d. \ 87\frac{3}{8} \\ - 28\frac{4}{5} \\ \hline \end{array}$$

$$\begin{array}{r} e. \ 73\frac{2}{3} \\ - 8\frac{7}{8} \\ \hline \end{array}$$

$$\begin{array}{r} f. \ 98\frac{3}{4} \\ - 29\frac{8}{9} \\ \hline \end{array}$$

$$\begin{array}{r} g. \ 65\frac{1}{6} \\ - 9\frac{2}{7} \\ \hline \end{array}$$

$$\begin{array}{r} h. \ 56\frac{2}{5} \\ - 47\frac{5}{8} \\ \hline \end{array}$$

### Multiplying Mixed Numbers

4. Write products directly from the book:

$$\begin{array}{r} a. \ 86\frac{2}{3} \\ \times 6 \\ \hline \end{array}$$

$$\begin{array}{r} b. \ 37\frac{2}{5} \\ \times 5 \\ \hline \end{array}$$

$$\begin{array}{r} c. \ 64\frac{3}{4} \\ \times 8 \\ \hline \end{array}$$

$$\begin{array}{r} d. \ 72\frac{1}{3} \\ \times 9 \\ \hline \end{array}$$

$$\begin{array}{r} e. \ 95\frac{1}{2} \\ \times 7 \\ \hline \end{array}$$

$$\begin{array}{r} f. \ 47\frac{2}{3} \\ \times \frac{1}{4} \\ \hline \end{array}$$

$$\begin{array}{r} g. \ 25\frac{2}{5} \\ \times 9 \\ \hline \end{array}$$

$$\begin{array}{r} h. \ 59\frac{4}{7} \\ \times 3 \\ \hline \end{array}$$

### Dividing Mixed Numbers

5. Write quotients from the book:

$$a. \ 2 \overline{)876\frac{2}{3}}$$

$$b. \ 3 \overline{)978\frac{2}{5}}$$

$$c. \ 4 \overline{)872\frac{1}{6}}$$

$$d. \ 2 \overline{)977\frac{1}{3}}$$

$$e. \ 3 \overline{)595\frac{1}{2}}$$

$$f. \ 4 \overline{)893\frac{1}{3}}$$

$$g. \ 2 \overline{)975\frac{1}{2}}$$

$$h. \ 3 \overline{)586\frac{1}{4}}$$

$$i. \ 4 \overline{)887\frac{1}{2}}$$

6. Write answers:

$$a. \ \frac{1}{2} \text{ of } 984\frac{2}{3}$$

$$b. \ \frac{1}{3} \text{ of } 969\frac{2}{5}$$

$$c. \ \frac{1}{4} \text{ of } 960\frac{4}{5}$$

$$d. \ \frac{1}{8} \text{ of } 673\frac{1}{2}$$

$$e. \ \frac{1}{6} \text{ of } 672\frac{1}{2}$$

$$f. \ \frac{1}{8} \text{ of } 963\frac{1}{2}$$

$$g. \ \frac{1}{4} \text{ of } 845\frac{1}{3}$$

$$h. \ \frac{1}{6} \text{ of } 488\frac{1}{2}$$

$$i. \ \frac{1}{9} \text{ of } 994\frac{1}{2}$$

# **Multiplying by 75, $37\frac{1}{2}$ , $62\frac{1}{2}$ , $87\frac{1}{2}$**

## *Preparatory Exercises*

- How many hundred pounds will 64 hams weigh at (a)  $\frac{1}{8}$  of 100 lb. each? (b) At  $12\frac{1}{2}$  pounds each?
- (a) How many bushels of wheat can be raised on 64 acres at the rate of  $37\frac{1}{2}$  bushels to the acre? (b) How many bushels of oats at  $62\frac{1}{2}$  bushels to the acre? (c) How many bushels of corn at  $87\frac{1}{2}$  bushels to the acre?

## *Written Exercises*

- How many tons of rails will a mill turn out in 308 days at the rate of (a)  $37\frac{1}{2}$  tons per day? (b)  $62\frac{1}{2}$  tons per day? (c)  $87\frac{1}{2}$  tons per day? (d) 75 tons per day?

### ANALYSIS

$$(a) \quad 37\frac{1}{2} \times 308 = \frac{300}{8} \times 308 = \frac{22400}{8} = 11550 \text{ (T.) } \textit{Ans.}$$

$$(b) \quad 62\frac{1}{2} \times 308 = \frac{500}{8} \times 308 = \frac{154000}{8} = 19250 \text{ (T.) } \textit{Ans.}$$

Write the numbers as shown below, and without writing 300, 500, 800, etc., multiply 308 in (a) by 300, in (b) by 500, and in (c) by 700, and divide each product by 8. In (d) multiply 308 by 300 and divide the product by 4.

### PROCESS

$$(a) \quad 308 \times 37\frac{1}{2} \text{ T.}$$

$$\begin{array}{r} 8 \overline{)92400} \text{ T.} \end{array}$$

$$\textit{Ans. } 11550 \text{ T.}$$

$$(b) \quad 308 \times 62\frac{1}{2} \text{ T.}$$

$$\begin{array}{r} 8 \overline{)154000} \text{ T.} \end{array}$$

$$\textit{Ans. } 19250 \text{ T.}$$

- Multiply by  $37\frac{1}{2}$ .
    - By  $62\frac{1}{2}$ .
    - By  $87\frac{1}{2}$ .
    - By 75.
- (a) 136    (b) 257    (c) 334    (d) 467    (e) 592  
(f) 677    (g) 734

**Multiplying by 99, etc.**

*Written Exercises*

1. What is the cost of 247 yards of silk (a) at 71¢ per yd. ? (b) At 69¢ ?

PROCESS		
(a) $247 \times 71¢$	(b) $247 \times 69¢$	In (b) deduct the product by 1 from the product by 7 tens.
$\begin{array}{r} 1729 \\ \hline \end{array}$	$\begin{array}{r} 1729 \\ \hline \end{array}$	
\$175.37 Ans.	\$170.43	

2. Find products :

- |                    |                    |                    |
|--------------------|--------------------|--------------------|
| a. $984 \times 19$ | b. $49 \times 624$ | c. $218 \times 79$ |
| d. $876 \times 29$ | e. $59 \times 547$ | f. $179 \times 89$ |
| g. $753 \times 39$ | h. $69 \times 432$ | i. $264 \times 79$ |

3. At \$145 per acre, find the cost (a) of 99 acres of land. (b) Of 999 acres.

PROCESS		
$\$145 \times 99$	$\$145 \times 999$	Deduct \$145 in (a) from 100 times \$145, in (b) from 1000 times \$145.
$\begin{array}{r} 14500 \\ \hline \end{array}$	$\begin{array}{r} 145000 \\ \hline \end{array}$	
\$14355 Ans.	\$144855	

4. Multiply by 99 :

- a. 234.      b. 345.      c. 456.      d. 567.      e. 678.

*Sight Exercises*

5. Give products :

- |                   |                   |                   |                   |
|-------------------|-------------------|-------------------|-------------------|
| a. $91 \times 99$ | b. $80 \times 29$ | c. $19 \times 50$ | d. $99 \times 87$ |
| e. $99 \times 92$ | f. $90 \times 39$ | g. $69 \times 40$ | h. $76 \times 99$ |
| i. $93 \times 99$ | j. $70 \times 49$ | k. $89 \times 30$ | l. $99 \times 65$ |
| m. $99 \times 94$ | n. $60 \times 59$ | o. $79 \times 20$ | p. $54 \times 99$ |

### Multiplication or Division

#### *Preparatory Exercises*

1. A storekeeper has 120 yards of cloth. How many yards has he sold when he has sold (a)  $\frac{1}{2}$  of it? (b)  $\frac{1}{3}$ ? (c)  $\frac{1}{4}$ ? (d)  $\frac{1}{5}$ ? (e)  $\frac{1}{6}$ ? (f)  $\frac{1}{8}$ ? (g)  $\frac{1}{10}$ ? (h)  $\frac{2}{3}$ ? (i)  $\frac{3}{4}$ ? (j)  $\frac{2}{5}$ ? (k)  $\frac{3}{5}$ ? (l)  $\frac{4}{5}$ ? (m)  $\frac{5}{6}$ ? (n)  $\frac{3}{8}$ ? (o)  $\frac{5}{8}$ ?

To find the answers to the foregoing questions, is 120 multiplied or divided by the respective fractions?

2. A grocer sold 60 pounds of coffee. How many pounds did he have at first if 60 pounds was (a)  $\frac{1}{2}$  the original quantity? (b)  $\frac{1}{3}$ ? (c)  $\frac{1}{4}$ ? (d)  $\frac{1}{5}$ ? (e)  $\frac{1}{6}$ ? (f)  $\frac{1}{8}$ ? (g)  $\frac{1}{10}$ ? (h)  $\frac{2}{3}$ ? (i)  $\frac{3}{4}$ ? (j)  $\frac{2}{5}$ ? (k)  $\frac{3}{5}$ ?

To find the answers to these questions, is 60 multiplied or divided by the respective fractions?

NOTE. — In dividing 60 by  $\frac{1}{3}$ ,  $\frac{1}{4}$ , etc., find  $\frac{1}{3}$ ,  $\frac{1}{4}$ , etc., of 60.

3. A farmer raised 120 tons of hay. What fraction of his crop did he sell if he sold (a) 10 T.? (b) 20 T.? (c) 30 T.? (d) 40 T.? (e) 60 T.? (f) 12 T.?

Is 120 the divisor or the dividend?

4. Mr. Schlaefers's hens laid on an average 120 eggs in 1914. By what fraction was 1914's average increased if the average in 1915 was (a) 130 eggs? (b) 140 eggs? (c) 150 eggs? (d) 160 eggs? (e) 180 eggs? (f) 132 eggs?

5. By what fraction would 1914's average of 120 eggs be diminished if it had fallen off to (a) 110 eggs? (b) 100 eggs? (c) 90 eggs? (d) 114 eggs?

6. (a) By what fraction is the yield of corn increased when it increases from 36 bushels to 40 bushels? (b) By what fraction is the yield diminished when it decreases from 40 bushels to 36 bushels?

7. A class has 40 pupils. What fraction is present when there are present (a) 39 pupils? (b) 38 pupils? (c) 37 pupils? (d) 36 pupils? (e) 35 pupils? (f) 34 pupils? (g) 32 pupils?

8. What fraction of a school of 120 pupils is absent when there are present (a) 118 pupils? (b) 117 pupils? (c) 116 pupils? (d) 115 pupils? (e) 114 pupils? (f) 112 pupils? (g) 110 pupils? (h) 108 pupils?

9. In a class there are 36 pupils present. How many belong to the class if (a)  $\frac{5}{6}$  of the pupils are present? (b)  $\frac{9}{10}$ ? (c)  $\frac{1}{3}$ ? (d)  $\frac{3}{4}$ ? (e)  $\frac{4}{5}$ ?

Is the number belonging to the class greater or less than 36?

When you divide by a proper fraction, is the quotient greater or less than the dividend?

10. How many pupils belong to a school if 120 are present and the fraction absent is (a)  $\frac{1}{8}$  of the whole number? (b)  $\frac{1}{4}$ ? (c)  $\frac{1}{6}$ ? (d)  $\frac{1}{8}$ ? (e)  $\frac{1}{7}$ ? (f)  $\frac{1}{9}$ ? (g)  $\frac{1}{11}$ ? (h)  $\frac{1}{13}$ ? (i)  $\frac{1}{16}$ ? (j)  $\frac{1}{21}$ ? (k)  $\frac{1}{25}$ ? (l)  $\frac{1}{31}$ ? (m)  $\frac{1}{41}$ ?

11. A girl pays 50 cents for 5 quarter-pound boxes of candy. (a) What was the price per box? (b) What was the price per pound?

12. At  $\$ \frac{3}{4}$  each, how many baseballs can be bought for \$12?

13. (a) When a man sells for \$180 a horse that cost him \$150, what fraction of the cost does he gain? (b) When a man sells for \$150 a horse that cost him \$180, what fraction of the cost does he lose?

*Sight Exercises*

1. A woman has 36 hens. How many does she sell if she sells (a)  $\frac{1}{2}$  of them? (b)  $\frac{1}{3}$ ? (c)  $\frac{2}{3}$ ? (d)  $\frac{1}{4}$ ? (e)  $\frac{3}{4}$ ?

2. A man buys a cow for \$36. What fraction of the cost does he gain if he sells it at a profit of (a) \$2? (b) \$3? (c) \$4? (d) \$6? (e) \$9? (f) \$12?

3. What fraction of the cost does a boy gain when he buys an article for 36 cents and sells it for (a) 40 cents? (b) 42¢? (c) 45¢? (d) 39¢? (e) 38¢?

4. What fraction of the cost is lost when an article costing 36 cents is sold for (a) 32 cents? (b) 34¢? (c) 33¢? (d) 30¢?

5. (a) What fraction of 36 is 27? (b)  $27 = 36$  multiplied by what? (c) What fraction of 27 is 36? (d) 27 multiplied by what equals 36?

6. (a) At \$ $\frac{2}{5}$  per pound, how much tea can be bought for \$ $\frac{2}{3}$ ? (b)  $\frac{2}{5} \div \frac{2}{3} = ?$  (c)  $60 \div 40 = ?$

7. (a) At \$ $\frac{3}{5}$  per yard, how much linen can be bought for \$ $\frac{2}{3}$ ? (b)  $\frac{2}{5} \div \frac{3}{5} = ?$  (c)  $40 \div 60 = ?$

*Written Exercises*

Find the missing quantity:

a.  $\frac{4}{5}$  of 120 = ?      b.  $\frac{4}{5}$  of ? = 96      c. 96 = ? of 120

Is the answer in (a) greater or less than 120?

In (b) is it greater or less than 96?

In (c) is it greater or less than 1?

d.  $75 = \frac{5}{8}$  of ?      e.  $\frac{2}{5}$  of ? = 108      f.  $48 = ?$  of 84  
 g.  $\frac{11}{8}$  of ? = 132      h.  $1\frac{5}{7} \times 16\frac{1}{3} = ?$       i.  $5\frac{1}{4} = \frac{17}{8}$  of ?  
 j.  $37\frac{1}{2} = ?$  of  $31\frac{1}{4}$       k.  $\frac{8}{9}$  of ? = 117      l.  $42\frac{1}{2} = 2\frac{1}{8} \times ?$   
 m.  $\frac{3}{8}$  of  $15\frac{3}{4} = ?$       n. ?  $\times 2\frac{2}{9} = 45$       o.  $\frac{7}{4}$  of ? =  $36\frac{3}{4}$

*Sight Drills*

1. What is the cost of  $\frac{1}{3}$  acres of land at \$60 per acre?

$$\frac{1}{3} \text{ times } \$60 = \text{Cost.}$$

2. Give answers:

$$\begin{array}{llll} a. \frac{1}{5} \times 60 = ? & b. \frac{3}{4} \times 16 = ? & c. \frac{4}{5} \times 24 = ? & d. \frac{7}{8} \times 48 = ? \\ e. \frac{1}{2} \times 70 = ? & f. \frac{4}{5} \times 36 = ? & g. \frac{1}{4} \times 88 = ? & h. \frac{2}{3} \times 24 = ? \\ i. \frac{1}{5} \times 40 = ? & j. \frac{3}{8} \times 32 = ? & k. \frac{5}{2} \times 60 = ? & l. \frac{5}{6} \times 72 = ? \end{array}$$

3. When 75 cents is paid for  $\frac{5}{4}$  yards of linen, what is the price per yard?

$$\text{When } \frac{5}{4} \times \text{price} = 75\text{¢, the price} = 75\text{¢} \div \frac{5}{4}.$$

$$\text{Ans. } \frac{4}{5} \text{ of } 75\text{¢. Why?}$$

4. Give answers:

$$\begin{array}{llll} a. \frac{5}{4} \times ? = 60 & b. \frac{3}{4} \times ? = 56 & c. \frac{4}{5} \times ? = 12 & d. \frac{4}{5} \times ? = 44 \\ e. \frac{2}{9} \times ? = 18 & f. \frac{1}{5} \times ? = 90 & g. \frac{4}{5} \times ? = 80 & h. \frac{1}{4} \times ? = 32 \end{array}$$

5. A quantity of lard at 18 cents per pound cost 27 cents. What was the quantity?

$$\text{When the number of pounds} \times 18\text{¢} = 27\text{¢, the number of pounds} = 27\text{¢} \div 18\text{¢}.$$

NOTE.—In giving answers to the following do not change the improper fractions in the results to mixed numbers.

6. Give answers in fractions, proper or improper:

$$\begin{array}{llll} a. ? \times 36 = 30 & b. ? \times 36 = 42 & c. ? \times 99 = 11 & d. ? \times 42 = 48 \\ e. ? \times 18 = 24 & f. ? \times 88 = 33 & g. ? \times 33 = 44 & h. ? \times 64 = 16 \end{array}$$

7. (a) At  $\frac{2}{5}$  mile per minute, how long would a train require to go  $\frac{3}{4}$  mile? (b) At  $\frac{3}{4}$  mile per minute, how long would a train require to go  $\frac{2}{5}$  mile?

8. Give answers:

$$\begin{array}{llll} a. 36 = 30 \times ? & b. 30 = 35 \times ? & c. 36 = 60 \times ? & d. 28 = 40 \times ? \\ e. 24 = 40 \times ? & f. 66 = 44 \times ? & g. 40 = 24 \times ? & h. 40 = 16 \times ? \\ i. 45 = 18 \times ? & j. 30 = 48 \times ? & k. 18 = 81 \times ? & l. 48 = 36 \times ? \end{array}$$



*Sight Problems*

1. If  $\frac{3}{4}$  bushels of seed wheat are used to the acre, how many acres will require 48 bushels of seed?
2. How much lace is used, on an average, in trimming a hat when 40 yards of lace are used in trimming 45 hats?
3. When coffee sells for 32 cents a pound, (a) how many ounces can be bought for 24 cents? (b) What fraction of a pound?
4. At the rate of  $\frac{3}{4}$  mile per minute, how far does a train go in an hour?
5. What part of a gross (12 dozen) of pencils has a stationer sold when he has sold 120 pencils?
6. When a boy has spent  $\frac{1}{5}$  of his money, (a) what fraction of it is left? (b) If he has 20 cents left, how much money had he at first?
7. After selling  $\frac{3}{4}$  of his sheep, a farmer still had 20 sheep. (a) How many sheep did he sell? (b) How many had he at first?
8. Last year Mr. X raised 24 bushels of wheat to the acre; this year he has raised 30 bushels to the acre. (a) This year's yield is what fraction of last year's? (b) The increase in this year's yield is what fraction of last year's yield?
9. Last year Mr. Y raised 30 bushels to the acre; this year he has raised only 24 bushels to the acre. (a) This year's yield is what fraction of last year's? (b) The decrease in this year's yield is what fraction of last year's yield?
10. Fred spent 60 cents and had 40 cents left. (a) What fraction of his money did he spend? (b) What fraction of it remained?

*Written Problems*

1. When  $\frac{3}{4}$  bushel of seed is used to plant an acre, how many acres can be planted with 117 bushels of seed?
2. If 112 yards of lace are used in trimming 12 dozen hats, how much is required on an average for each?
3. When velvet sells at \$2.25 per yard, (a) what part of a yard can be bought for \$1.75? (b) How many inches? (c) How many feet and inches?
4. At the rate of  $\frac{3}{5}$  mile per minute, how far can a train go in  $2\frac{1}{2}$  hours?
5. What part of a gross of pens is  $10\frac{3}{4}$  dozen pens?
6. After selling  $\frac{2}{5}$  of his land, a man has 450 acres remaining. How many acres had he at first?
7. After selling  $\frac{2}{5}$  of his farm, M has  $213\frac{1}{2}$  acres left. (a) How many acres did he sell? (b) How many acres were there in the farm?
8. Last year's crop averaged  $22\frac{1}{2}$  bushels of wheat to the acre; this year averaged  $31\frac{1}{2}$  bushels. (a) This year's yield is what fraction of last year's? (b) The increased yield is what fraction of last year's average?
9. Mr. Cox raised last year  $31\frac{1}{2}$  bushels to the acre; this year he raised only  $22\frac{1}{2}$ . What fraction of last year's yield is this year's yield?
10. After spending \$18 $\frac{3}{4}$  for clothes, a boy has \$12.50 left. (a) What fraction of his money did he spend? (b) What fraction remained?
11. A woman paid \$1.65 for 5 three-quarter pound packages of tea. Find (a) the price of each package. (b) The cost of the tea by the pound.
12. At \$ $3\frac{3}{4}$  per pound, how many pounds of tea will cost \$18 $\frac{3}{4}$ ?

**Bill for Goods Bought at One Time**LOUISVILLE, KY., *Feb. 29, 1916.*

Mr. HUNTER COLLINS

Bought of KELLY &amp; WARREN.

25 lb. Sugar	.05½	1	38	
1 bbl. Flour		5	75	
10 lb. Bacon	.12½			
2 lb. Tea	.45			
Received payment, Mch. 6, 1916,				\$
Kelly & Warren,				
per S. M. Y.				

This is a bill for purchases made Feb. 29, 1916. It was paid March 6, 1916, to the clerk who writes his initials under the name of the firm.

1. Copy the foregoing bill, filling in the missing amounts.

2. Make out a bill for the following articles sold to-day by M. L. Hutchinson to F. Curtis: 12½ yd. Dress Goods, @ 40¢; 5 yd. Ribbon, @ 63¢; 10 yd. Silk, @ 75¢; 1 Hat, \$8.75. J. H. Bancroft, a clerk, receipts the bill.

**Bill for Services and Material Supplied**BISMARCK, N. D., *May 5, 1916.*

Mr. JAMES P. HANEY

To A. S. CASWELL, Dr.

To 5 Roses	.25			
" 25 Geraniums	.10			
" 3 Maples	.75			
" 40 Pansies	.05			
" Labor, Fertilizer, etc.		2	75	\$

**NOTE.** Bills for goods purchased may employ the heading "Bought of," "Sold to," or the one used above. The heading here given is the appropriate one for a bill including services rendered.

1. Copy the foregoing bill, filling in the amounts, and receipt it as paid on May 10.

2. James H. Tully presents a bill to you, dated to-day, containing the following items: 15 days cutting wood, @ \$1.75; 6 days hauling ice, @ \$2.50; 10 days shelling corn, @ \$1.50. Make out his bill.

3. On the above bill credit a cash payment of \$30 on the first of the preceding month, and receipt it for the balance on the 20th of the current month.

### Bill for Goods Bought at Different Times

MARIETTA, O., July 1, 1916.

W. S. GOODNOUGH & Co.

Sold to L. H. GULICK.

1908								
June	1	5 M Flooring	32.00					
"	10	2½ M Lath	5.00					
"	10	3 kegs Nails	2.50					
"	12	4 M Scantling	24.00					
"	20	2 M Joists	20.00					
"	20	1½ M Scantling	24.00					
"	20	2 M Lath	5.15			\$		
"	30	By Cash					25	00
"		Balance due				\$		

1. Complete the foregoing bill. Receipt it for L. H. Gulick, adding your initials as clerk.

2. Make out a bill of several items bought at a grocery during the present month.

3. Make out a bill for labor in making a garden and for supplying fertilizer and plants.

## Household Problems

1. Mr. Watson earns \$30 per week. (a) What does he earn in 52 weeks? He spends 25 % of it in rent. (b) What is his monthly rent? The food for his family costs 30 % of his earnings. (c) What does it cost per week? His bills for gas, fuel, repairs, etc., average 10 % of his earnings. (d) What do they cost per month? He spends 20 % for clothing for his family. (e) What is the annual cost? (f) What is left for recreation, doctor's bills, insurance, charity, church dues, etc. ?

2. Find the cost of each of the following meals, the cost for each day, and the total cost for the week, including in the latter 25¢ for the cost of lard, pepper, salt, etc.

The prices given cover cost for two adults and four children.

## FIRST DAY

<i>Breakfast</i>		<i>Dinner</i>		<i>Supper</i>	
Cereal—milk—sugar	8¢	Baked macaroni and cheese	5½¢	French toast	4¢
Bread and butter	6½	Spinach	5½	Stewed apricots	9
Codfish	12	Stewed peaches	8	Cocoa—milk—sugar	9
Coffee—milk	6	Coffee—milk—sugar	6		

## SECOND DAY

<i>Breakfast</i>		<i>Dinner</i>		<i>Supper</i>	
Cereal—milk—sugar	8¢	Ox-tail stew	15¢	Cheese on toast	6½¢
Eggs	16	Carrots	2	Escarole salad	11½
Bread and butter	6½	Bread and butter	6½	Apple sauce	6
Coffee—milk—sugar	6	Custard and bananas	16	Tea—milk—sugar	5

## THIRD DAY

<i>Breakfast</i>		<i>Dinner</i>		<i>Supper</i>	
Cereal—milk—sugar	8¢	Flank steak	20¢	Milk toast	4¢
Biscuit—butter	10	Onions	5	Lettuce salad	11½
Eggs	16	Bread and butter	6½	Molasses cake	6
Coffee—milk—sugar	6	Lemon jelly	12	Cocoa—milk—sugar	9

## FOURTH DAY

<i>Breakfast</i>		<i>Dinner</i>		<i>Supper</i>	
Corn bread—butter	10¢	Pot roast	18¢	Boston baked beans	10¢
Omelets	12	Macaroni	4	Bread and butter	6½
Coffee—milk—sugar	6	Bread and butter	6½	Cabbage salad	10
		Junket	8	Sliced oranges	5
		Coffee—milk—sugar	6	Tea—milk—sugar	5

## FIFTH DAY

<i>Breakfast</i>		<i>Dinner</i>		<i>Supper</i>	
Corn bread—butter	10¢	Cold meat	18¢	Egg salad	18¢
Hashed potatoes	2	Rice and tomatoes	11	Bread and butter	6½
Coffee—milk—sugar	6	Apple pudding	16	Prunes	4
				Tea—milk—sugar	5

## SIXTH DAY

<i>Breakfast</i>		<i>Dinner</i>		<i>Supper</i>	
Cereal—milk—sugar	8¢	Hash balls	12¢	Lentil soup	8¢
Bread and butter	6½	Peas	9	Biscuits—cheese	12
Scrambled eggs	16	Bread and butter	4½	Tea—milk—sugar	5
Coffee—milk—sugar	6	Custard	10		
		Coffee—milk—sugar	6		

## SEVENTH DAY

<i>Breakfast</i>		<i>Dinner</i>		<i>Supper</i>	
Baked apple	8¢	Baked haddock	18¢	Fried hominy—syrup	5¢
Milk toast	8	Escalloped tomatoes	6	Apple sauce	6
Coffee—milk—sugar	6	Creamed potatoes	9	Cocoa—milk—sugar	9

3. Find the weekly cost of the following items of a United States Navy ration:

## ALLOWANCE PER DAY

1½ lb. meat	@ 12¢	½ lb. coffee	@ 16¢
1½ lb. potatoes	@ 1½¢	1½ qt. milk	@ 8¢
1½ lb. bread	@ 4¢	½ lb. sugar	@ 6¢
1½ lb. apples	@ 2¢	½ lb. butter	@ 32¢

## ALLOWANCE PER WEEK

½ lb. macaroni	@ 6¢	1½ lb. mustard	@ 48¢
½ lb. cheese	@ 16¢	1½ lb. spices	@ 16¢
½ lb. tomatoes	@ 20¢	1½ gal. vinegar	@ 16¢
½ lb. salt	@ 1¢	½ gal. pickles	@ 16¢
½ lb. pepper	@ 16¢	½ gal. molasses	@ 24¢

## Household Accounts

Although Mrs. Mullaly runs no bills except for milk, ice, and gas, she finds it possible to make better use of the money allotted to household expenses by keeping an account in the following form, using an ordinary memorandum book:

EXPENSES			Dr.	Cr.
1914				
Aug.	1	Cash on hand	48	42
	8	Groceries (for week)		1 80
		Baker		1 05
		Milk, Butter, Eggs		2 56
		Vegetables		60
		Fruit		42
		Ice		35
		Cash rec'd	25	—
		Balance		66 64
			73	42
	10	Cash on hand	66	64
		Savings Bank		30 —

The foregoing entries are made weekly from slips received from the grocer, butcher, etc., at the time of each purchase. The weekly balance should agree with the cash on hand.

The account is balanced by adding the Dr. column, inserting the total (73.42) in this column and also in the Cr. column, then writing the sum (66.64) needed to make the total. As this is not an expenditure, it is written in red ink by bookkeepers. The account is reopened on August 10 by writing Cash on hand, with the amount (\$66.64).

*Written Exercises*

1. Copy the foregoing account and extend it another week. Include one or more purchases of dry goods, etc. Balance the account Aug. 15, and reopen it Aug. 17.

2. Henry Schamell received a bill from Meissner and Brunkhurst for \$187.50 for furniture purchased during September, 1914. He mails the following check in payment:

No. 473	PORTLAND, OREGON, Oct. 1, 1914
NATIONAL SCHOOL BANK	
Pay to the order of <i>Meissner and Brunkhurst</i>	
<i>One Hundred Eighty-seven</i> $\frac{50}{100}$ <i>Dollars</i>	
(In school currency)	
\$187 $\frac{50}{100}$	<i>Henry Schamell</i>

To obtain the money for the foregoing check Meissner and Brunkhurst must *indorse* it; that is, a member of the firm must write the firm's name on the back. When Mr. Schamell finally receives it from his bank, after it has been paid, he retains it as a receipt.

3. Make out a bill for groceries purchased at different times during a month. Try to make the quantities such as would be needed by a family of four adults.

4. Make out a check in the foregoing form for the groceries purchased in the last exercise. Use the names of the buyer and seller as found in the bill.



4. Copy the following account of a girl's receipts and expenditures, extend it another week, close it at the end of the week (Saturday) and reopen it Monday :

		CASH	Dr. Cr.	
1914				
Dec.	7	On hand	1 74	
	9	Allowance	75	
	10	Materials for hat		1 78
	11	Candy		10
	12	Gift from Uncle	1 50	
		Renovating dress		78
		“ hat		75
		Balance		58.
			3 99	3 99
Dec.	14	On hand	58	

5. Find the cost of the following materials (a) for a straw hat: 1 piece straw braid, 79 ¢; wire for frame, 10 ¢; 1 yd. cotton mull, 10 ¢; 1 yd. silk (trimming), 69 ¢; lining, 10 ¢. (b) For renovating dress:  $2\frac{1}{2}$  yd. Persian lawn @ 15 ¢; 5 yd. embroidery insertion @ \$.08. (c) For renovating hat:  $\frac{3}{4}$  yd. black silk @ 69 ¢; 1 ostrich quill, 23 ¢. The other materials were supplied by the old hat and the old dress.

## SECTION III

### PERCENTAGE, INTEREST, MEASUREMENTS, REVIEWS, SHORT METHODS

#### Percentage

#### *Preparatory Exercises*

1. Out of 12 examples worked by a boy, his answers to 10 of them were correct. What fraction of correct answers did he get?

2. Out of 16 examples worked by a girl, her answers to 14 of them were correct. What fraction of correct answers did she get?

3. Which fraction is greater,  $\frac{5}{8}$  or  $\frac{7}{8}$ ?

4. To compare  $\frac{5}{8}$  and  $\frac{7}{8}$  what is necessary?

5. What fraction of correct answers is obtained by a pupil that gets 12 correct answers to 15 examples?

6. What is the common denominator of the fractions  $\frac{4}{8}$ ,  $\frac{5}{8}$ , and  $\frac{7}{8}$ ?

7. How many cents (a) in  $\$ \frac{4}{8}$ ? (b) in  $\$ \frac{5}{8}$ ? (c) in  $\$ \frac{7}{8}$ ?

8. Change to per cents: (a)  $\frac{4}{8}$ ; (b)  $\frac{5}{8}$ ; (c)  $\frac{7}{8}$ .

9. (a) If a club wins 17 games out of 20, how many would it win out of a hundred at the same rate? (b) How many games out of a hundred should be won by a club that wins 21 out of 25?

10. Change to per cents: (a)  $\frac{1}{2}\frac{7}{8}$ ; (b)  $\frac{3}{2}\frac{1}{8}$ .

11. Change to fractions:

a. 50% b.  $12\frac{1}{2}\%$  c.  $6\frac{1}{4}\%$  d.  $87\frac{1}{2}\%$  e.  $\frac{1}{2}\%$  f. 12.5%

*Written Exercises*

1. A man bought a tract of land for \$4500. What was his profit if he sold it at an advance (a) of 140%? (b) Of  $4\frac{1}{2}\%$ ? (c) Of 3.4%? (d) Of  $\frac{3}{4}\%$ ?

## PROCESS

(a) \$4500

$$\begin{array}{r} 1.40 \\ \hline \end{array}$$

$$\begin{array}{r} 180000 \\ \hline \end{array}$$

$$\begin{array}{r} 4500 \\ \hline \end{array}$$

$$\begin{array}{r} \$6300.00 \text{ Ans.} \end{array}$$

(b) \$4500

$$\begin{array}{r} .04\frac{1}{2} \\ \hline \end{array}$$

$$\begin{array}{r} 2250 \\ \hline \end{array}$$

$$\begin{array}{r} 18000 \\ \hline \end{array}$$

$$\begin{array}{r} \$202.50 \text{ Ans.} \end{array}$$

(c) \$4500

$$\begin{array}{r} .034 \\ \hline \end{array}$$

$$\begin{array}{r} 18000 \\ \hline \end{array}$$

$$\begin{array}{r} 13500 \\ \hline \end{array}$$

$$\begin{array}{r} \$153.000 \text{ Ans.} \end{array}$$

(d) \$4500

$$\begin{array}{r} .00\frac{3}{4} \\ \hline \end{array}$$

$$\begin{array}{r} 4)13500 \\ \hline \end{array}$$

$$\begin{array}{r} \$33.75 \text{ Ans.} \end{array}$$

Change the given per cent to a decimal by pointing off in the former two decimal places in addition to any originally contained therein.

When there is a fraction in the original per cent, the latter may be written as a complex decimal.

## 2. Find:

- a.  $2\frac{2}{3}\%$  of \$316    b. 205% of 180 yd.    c.  $83\frac{1}{3}\%$  of 150 bu.  
d.  $4\frac{1}{8}\%$  of 128 lb.    e. 138% of \$150    f.  $31\frac{1}{4}\%$  of \$160

*Sight Exercises*

Give answers:

a.  $12\frac{1}{2}\%$  of 648 sheep

c.  $6\frac{1}{4}\%$  of \$176

e. 25% of 488 tons

g. 50% of 864 pounds

i.  $33\frac{1}{3}\%$  of 969 yards

k.  $16\frac{2}{3}\%$  of 468 gallons

m.  $8\frac{1}{3}\%$  of 360 bushels

b.  $\frac{1}{8}\%$  of \$648

d.  $\frac{1}{16}\%$  of \$176

f.  $\frac{1}{4}\%$  of 40 T.

h.  $\frac{1}{2}\%$  of 800 lb.

j.  $\frac{1}{8}\%$  of \$969

l.  $\frac{1}{6}\%$  of \$486

n.  $\frac{1}{12}\%$  of \$360

*Written Exercises*

1. A butcher bought sheep weighing 2592 pounds alive. What is the loss in weight if  $66\frac{2}{3}\%$  of the live weight is lost in dressing, and in bones, etc., that are not eaten?

## PROCESS

$$66\frac{2}{3}\% \text{ of } 2592 \text{ lb.} = \frac{864}{1} \times \frac{2}{3} = 1728 \text{ lb. } \textit{Ans.}$$

2. Find the results :

a.  $12\frac{1}{2}\%$  of \$3888

b.  $37\frac{1}{2}\%$  of \$2688

c.  $6\frac{1}{4}\%$  of 8336 T.

d.  $62\frac{1}{2}\%$  of 3976 men

e.  $33\frac{1}{3}\%$  of 3456 lb.

f.  $87\frac{1}{2}\%$  of 4304 cows

g.  $16\frac{2}{3}\%$  of 6354 yd.

h.  $66\frac{2}{3}\%$  of 1236 da.

i.  $8\frac{1}{3}\%$  of 5364 ft.

j. 75 % of 4248 mi.

3. A farmer cultivates  $87\frac{1}{2}\%$  of his farm of 365 acres. How many acres and square rods are cultivated?

## PROCESS

$$87\frac{1}{2}\% \text{ of } 365 \text{ A.} = \frac{7}{8} \text{ of } \frac{295}{1} \text{ A.} = \frac{2555}{8} \text{ A.} = 319\frac{3}{8} \text{ A.} \\ = 319 \text{ A. } 60 \text{ sq. rd. } \textit{Ans.}$$

NOTE. —  $\frac{3}{8} \text{ A.} = \frac{1}{4}$  of 160 sq. rd.

4. Express results as compound denominate numbers :

a.  $12\frac{1}{2}\%$  of 175 bu.

b.  $37\frac{1}{2}\%$  of 275 bu.

c.  $6\frac{1}{4}\%$  of 276 gal.

d.  $62\frac{1}{2}\%$  of 375 gal.

e. 25 % of 383 A.

f.  $87\frac{1}{2}\%$  of 481 A.

g. 50 % of 433 mi.

h.  $66\frac{2}{3}\%$  of 247 yd.

i.  $33\frac{1}{3}\%$  of 52 wk.

j. 75 % of 117 yr.

k.  $\frac{2}{3}\%$  of 420 miles.

l.  $\frac{1}{8}\%$  of \$960.

*Sight Problems*

1. A man insured his house for \$500, at a cost of  $\frac{1}{2}$  % of 1 % of this amount. How much did it cost?
2. A boy has 36 marbles. How many would he have after losing 25 % of them?
3. A baseball club played 40 games and won  $87\frac{1}{2}$  % of them; how many games did it win?
4. In a class of 20 pupils 45 % are girls; how many boys are there in the class?
5. John bought a dog for \$2 and sold it for 30 % more than he paid. How much did he receive for the dog?
6. Of the population of a certain village 5 % caught the measles. If the population was 860, how many were taken sick with the measles?
7. A man placed 300 tons of hay in the barn. If it lost 2 % in weight by the time he sold it, how many tons did it then weigh?
8. In selling a suit, a dealer makes a deduction of 10 % on the marked price. If the marked price is \$25, (a) how much is the deduction? (b) What is the selling price?
9. In a storm 2 % of the trees in an orchard were blown down. If the orchard contained 150 trees, how many were blown down?
10. A girl buys eggs at 25 cents a dozen, and sells them for 20 % more than they cost. (a) What does she receive a dozen for them? (b) How much does she receive for 10 eggs?
11. When the death rate in a city is 14.5 per thousand, what is the rate per cent?

*Written Problems*

1. A barn worth \$4000 is insured for 85 % of its value. (a) For how much is it insured? (b) How much does the insurance cost at  $\frac{3}{4}$  % of the sum for which it is insured?

2. A farmer has raised 3296 bushels of wheat. How many bushels has he after selling 25 % of the crop?

3. A club has played 40 games of ball and has won  $72\frac{1}{2}$  % of them. How many games has it lost?

4. In a class of 36 pupils  $44\frac{4}{5}$  % of them are boys: how many girls are there in the class?

5. A dealer bought a horse for \$175 and sold it at 12 % more than the cost. What was the selling price?

6. In a village having a population of 860, 15 % of the population voted. How many votes were cast?

7. When 96 % of the pupils of a school are present, how many pupils are absent if there are 450 pupils belonging to the school?

8. A dealer advertises a reduction of 12 % on furniture. (a) How much is this reduction on a parlor set previously sold for \$125? (b) What is the new price?

9. Four per cent of a man's crop of 175 bushels of apples were spoiled. How many bushels of sound apples were left?

10. A dealer pays \$4.80 for a case of 30 dozen eggs. If he sells them at a profit of  $12\frac{1}{2}$  %, how much does he receive for them by the dozen?

11. How many deaths in a city of 12,000 inhabitants will give a death rate of 1.45 %?

12. After deducting 42 % of a number the remainder is 1160; what is the number?

13. After spending 40 % of my money for land and 25 % of it for stock, how much shall I have left of \$30,000?

14. A man begins work at a salary of \$1000. If he receives each year 10 % more than he received the previous year, what is his salary for the fourth year?

15. A road supposed to be 10 miles long is found to be 15 % of a mile short of that length. What is its length in miles and rods?

16. In a school of 120 pupils, 25 % are in room A, 30 % are in room B, 20 % are in room C, and the remainder are in room D. (a) How many are there in each room? (b) What per cent of the pupils are in room D?

17. A man loses 10 % of his money and then loses 20 % of the remainder. (a) What fraction of his money has he lost? (b) What per cent of his money?

18. C has \$100. A has 10 % more money than B, and B has 10 % more than C. What per cent more money than C has A?

19. A dealer pays \$40 for a table. He marks it 25 % above cost and sells it 10 % below the marked price. What does he receive for it?

20. When  $2\frac{1}{2}$  % of a school of 520 pupils are absent, how many are present?

21. The weekly pay roll of a factory is \$4500. What would it be if it were increased  $7\frac{1}{2}$  %?

22. A merchant sold a bill of goods, amounting to \$700, of which he received a payment of 75 % on account and a later payment of 80 % of the amount then due. (a) What amount is then unpaid? (b) What fraction of the original bill is unpaid? (c) What per cent?

## Interest

## THE LENDER

A person with spare money is anxious to increase his income by the rent received from another for its use. A sum as small as \$1 can be loaned to the United States by means of a postal savings bank. Larger sums are loaned to a regular bank, to an individual, to a city, etc.

## SECURITY FOR THE LOAN

A loan is frequently made to an individual without further security than his reputation for honesty. Loans to savings banks are safeguarded by the state. A loan to the owner of property is secured by the latter's written agreement to permit the sale of the property if the interest is not paid at the stated periods or the principal when due.

## EVIDENCE OF THE LOAN

A person loaning money to the United States, to a city, to a railroad, etc., receives a document called a *bond*, which specifies the sum loaned, the time it is due, the rate of interest, and the dates of the interest payments.

A loan to a savings bank is acknowledged by the entry of the sum in the bankbook of the lender.

A loan to Paul Peters by Henry Beck is acknowledged by the following *promissory note*.

LINCOLN, NEBRASKA, Aug. 2, 1914

*On demand after date I promise to pay to Henry Beck, or order, Six Hundred  $\frac{00}{100}$  Dollars, value received, at my office, 136 Jackson Ave., with interest at six per cent.*

\$600  $\frac{00}{100}$

PAUL PETERS



## THE BORROWER

By borrowing \$1000 for sixty days, a merchant is frequently able to take advantage of favorable prices, whereby he saves several times the interest on the sum borrowed. A manufacturer borrows money for the purchase of raw material, repaying it with interest when the products are sold. A railroad borrows money for a long period to make extensions, the income of which is expected to pay the interest charges and to supply funds for the payment of the principal at the specified time.

A town that needs a new \$50,000 school is frequently unwilling to collect the entire cost in the taxes of a single year, preferring to spread it over ten or a dozen years by borrowing the money for that time, paying interest half yearly.

*Sight Exercises*

1. Considering a year to consist of 12 months of 30 days each, what is the interest on \$600 at 6% (a) for 1 year? (b) For 1 day? (c) For 60 days? (d) For 93 days?

2. What fraction of a year is (a) 180 days? (b) 90 days? (c) 45 days? (d) 72 days? (e) 120 days? (f) 60 days? (g) 40 days?

$$\text{Interest} = \text{Principal} \times \text{Rate (in hundredths)} \times \text{time (in years)}.$$

3. Give the interest on :

- |  |                             |
|--|-----------------------------|
| a. \$100, at 6%, for $\frac{1}{8}$ yr. | b. \$100, at 6%, for 60 da. |
| c. \$200, at 5%, for $\frac{1}{6}$ yr. | d. \$300, at 5%, for 72 da. |
| e. \$300, at 8%, for $\frac{1}{8}$ yr. | f. \$400, at 8%, for 45 da. |
| g. \$400, at 4%, for $\frac{3}{4}$ yr. | h. \$200, at 4%, for 90 da. |
| i. \$500, at 6% for $\frac{2}{3}$ yr.  | j. \$600, at 6%, for 30 da. |

*Written Exercises*

1. Mr. Peters borrows \$275. He repays the loan in 2 years and 6 months with interest at 6%. How much does he pay?

PROCESS

\$275	Principal
$\times .06$	Rate
<hr/> \$16.50	Interest for 1 yr.
$\times 2\frac{1}{2}$	Time in years
<hr/> 8.25	
33.00	
<hr/> \$41.25	Interest for $2\frac{1}{2}$ yr.
275	Principal
<hr/> Ans. \$316.25	Amount

Find the interest for 1 year by multiplying \$275 (the principal) by .06 (the rate expressed as hundredths).

Multiply \$16.50 (the interest for 1 yr.) by  $2\frac{1}{2}$  (the time in years). To \$41.25 (the interest) add \$275 (the principal), which gives \$316.25 (the amount).

The sum on which the interest is taken is called the *principal*. The *amount* is the total of the principal and the interest.

2. Find the interest on :

- a. \$250 at 3% for 1 yr.      b. \$360 at 5% for  $2\frac{1}{2}$  yr.  
c. \$180 at 4% for 3 yr.      d. \$400 at 4% for  $1\frac{1}{4}$  yr.

3. Find the amount of :

- a. \$250 at 5% for 1 yr.      b. \$360 at 4% for  $2\frac{1}{2}$  yr.  
c. \$180 at 6% for 3 yr.      d. \$400 at 5% for  $1\frac{1}{4}$  yr.

4. Find the interest on :

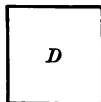
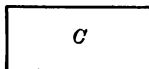
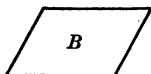
- a. \$250 at 6% for 6 mo.      b. \$360 at  $4\frac{1}{2}$ % for 30 da.

5. Find the amount of :

- a. \$250 at 4% for  $\frac{1}{4}$  yr.      b. \$360 at 6% for 60 da.

### Quadrilaterals

A figure of four sides is called a *quadrilateral*. *A*, *B*, *C*, and *D* are quadrilaterals. When a quadrilateral has its opposite sides equal and parallel, it is called a *parallelogram*.



*B*, *C*, and *D* are parallelograms.

When the angles of a parallelogram are right angles, it is called a *rectangle*.

*C* and *D* are rectangles.

When a rectangle has four equal sides, it is called a *square*.

*D* is a square.

Take a strip of paper 2 inches wide and cut from it four parallelograms of different shapes, but each having a base 3 inches long.

The area of each of these parallelograms will be 6 sq. in.

Test the equality of these parallelograms by changing each into a rectangle  $3'' \times 2''$ . Do this by cutting along a perpendicular line *CX*, p. 213, and transferring the triangle *CXB* from the right to the left.

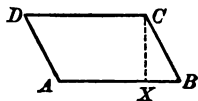
The dotted line in each of the parallelograms, corresponding with *CX*, is called the *altitude*, or the *perpendicular*. In the rectangle, the perpendicular is one of the sides. In parallelograms not rectangles, the line measuring the perpendicular is not one of the sides.

Any side of a parallelogram may constitute one of its dimensions, the perpendicular distance between this side and the one opposite being the other dimension.

Any two adjacent sides of a rectangle constitute its dimensions.

## Areas of Parallelograms

To ascertain the area of the parallelogram  $ABCD$  measure the length of  $AB$  (or of  $CD$ ) and also the length of the perpendicular  $CX$ .



$\text{Area of parallelogram} = \text{Base} \times \text{Perpendicular}$
--

*Sight Exercises*

Give the area of each of the following parallelograms:

- Base, 50 rods; perpendicular, 84 rods.
- Base, 96 feet; perpendicular, 125 feet.
- Base, 31 yards; perpendicular, 16 yards.
- Base, 66 inches; perpendicular,  $16\frac{2}{3}$  inches.
- Base 75 feet; perpendicular 48 feet.
- Base 48 miles; perpendicular  $33\frac{1}{3}$  miles.

*Written Exercises*

Express each dimension in the linear unit corresponding to the square unit in which the area is required.

1. A field in the form of a parallelogram is  $\frac{1}{2}$  mile long, and its perpendicular is 70 rods. How many acres does it contain?

2. How many square rods are there in a road a mile long and 66 feet wide?

3. How many square yards are there in a rectangular rug 8 yd. 2 ft. 8 in. long, 4 yd. 1 ft. 6 in. wide?

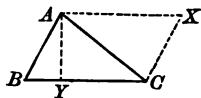
4. An acre contains 4840 square yards. How many acres are there in a field whose dimensions are 330 feet by 132 feet?

5. Find the area (in acres) of a square field whose perimeter is 320 rods.

### Areas of Triangles

The triangle  $ABC$  is one half the area of the parallelogram  $ABCX$ .

Since the area of the parallelogram is the product of  $BC$  by  $AY$ , the area of the triangle  $ABC$  is  $\frac{1}{2}$  the product of  $BC$  by  $AY$ .



$\text{Area of triangle} = \frac{1}{2} (\text{Base} \times \text{Perpendicular})$
---

### Preparatory Exercises

The triangle  $ABC$  is divided into two right triangles by the perpendicular  $AY$ . When the length of  $AY$  is 2 inches, that of  $BY$  1 inch, and that of  $CY$  3 inches,

- a. How long is  $BC$ ?
- b. What is the area of  $ABY$ ?
- c. Give the area of  $AYC$ .
- d. What is the sum of these areas?
- e. Give the area of  $ABC$ .

### Sight Exercises

Give the area of triangles having dimensions as follows :

- a. Base,  $37\frac{1}{2}$  rods ; perpendicular, 64 rods.
- b. Base,  $16\frac{2}{3}$  yards ; perpendicular 36 feet.
- c. Base,  $62\frac{1}{2}$  feet ; perpendicular, 96 inches.
- d. Base,  $8\frac{1}{3}$  yards ; perpendicular 36 feet.

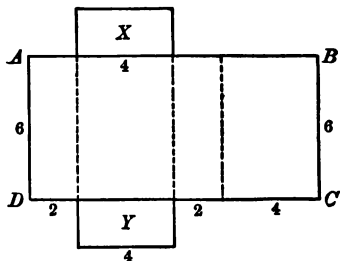
### Written Exercises

1. How many acres are there in a triangular field whose base measures 480 rods and whose altitude is 76 rods?
2. A triangular field contains 4 acres. What is its altitude when the base is a mile in length?

### Surfaces of Rectangular Solids

The *entire surface* of a rectangular solid includes all six faces. The *convex surface* excludes the two bases.

The accompanying figure shows the diagram of a piece of paper that would exactly cover a solid 6 in. high, 4 in. long, 2 in. wide. Calling the two rectangles *X* and *Y* the bases, the rectangle *ABCD* represents the convex surface.



#### Sight Exercises

1. What is the area of each of the bases?
2. What is the area of each of the two largest faces?
3. What is the area of the two remaining faces?
4. What is the area of *ABCD*?

$$\text{Convex Surface} = \text{Perimeter of Base} \times \text{Altitude}$$

#### Written Exercises

1. (a) What is the convex surface of a cube each side of which is 15 in.? (b) What is the entire surface?
2. A room is 15 feet long, 12 feet wide, and 9 feet high. (a) How many square yards of plastering does the ceiling require? (b) How many running yards of plastering 9 feet high are required for the walls? (c) How many square yards of plastering are required, allowing 12 sq. yd. for openings? (d) How many square yards of carpet are needed to cover the floor?

**Volumes of Rectangular Solids***Written Exercises*

1. How many cubic feet of corn are there in a corn crib 16 ft. long and 12 ft. wide when the corn is 8 ft. deep?

2. (a) How many cubic feet of earth are removed in digging a cellar 48 ft. long, 21 ft. wide, and 9 ft. deep?

(b) How many tons does it weigh at 21 cu. ft. to the ton?

3. (a) How many cubic inches are there in a brick  $8'' \times 4'' \times 2''$ ? (b) How many bricks are there to the cubic foot? (c) How many cubic inches are there in a brick  $8'' \times 4'' \times 2\frac{1}{2}''$ ?

4. At 21 bricks (including mortar) to the cubic foot, how many bricks are required for a wall 150 ft. long, 1 ft. thick, 6 ft. high?

5. (a) How many cubic feet are there in a piece of lumber 12 ft. long, 6 in. wide, and 6 in. thick?

(b) What is its weight at 36 pounds to the cubic foot?

6. (a) How many cubic feet are there in a block of ice 4 ft. long, 2 ft. wide,  $1\frac{1}{2}$  ft. thick? (b) What is its weight at 58 pounds to the cu. ft.? (c) Find the weight of an equal volume of water at  $62\frac{1}{2}$  lb. to the cu. ft.

*Sight Exercises*

Give the areas of the following rectangles in square units corresponding with the given linear units:

a. 16 ft. by 25 ft.

b. 99 ft. by 99 ft.

c. 24 yd. by  $12\frac{1}{2}$  yd.

d. 99 rd. by 51 rd.

e. 36 rd. by  $33\frac{1}{3}$  rd.

f. 21 in. by 13 in.

g. 20 in. by 8.5 in.

h. 88 yd. by 25 yd.

i. 40 mi. by 6.1 mi.

j. 60 rd. by  $16\frac{2}{3}$  rd.

*Sight Drills*

1. Give sums :

$$749 + 134 = 749 + 100(849) + 30(879) + 4$$

- a.  $175 + 84$    b.  $672 + 126$    c.  $861 + 129$    d.  $363 + 154$   
 e.  $263 + 95$    f.  $715 + 243$    g.  $758 + 137$    h.  $281 + 176$   
 i.  $346 + 63$    j.  $804 + 155$    k.  $639 + 143$    l.  $377 + 162$   
 m.  $451 + 78$    n.  $533 + 233$    o.  $527 + 164$    p.  $465 + 153$   
 q.  $572 + 54$    r.  $441 + 156$    s.  $446 + 138$    t.  $548 + 181$

2. Give remainders :

$$321 - 176 = 321 - 100(221) - 70(151) - 6(145)$$

- a.  $960 - 84$    b.  $798 - 132$    c.  $320 - 186$    d.  $513 - 184$   
 e.  $847 - 98$    f.  $958 - 416$    g.  $430 - 237$    h.  $418 - 179$   
 i.  $753 - 69$    j.  $839 - 527$    k.  $540 - 194$    l.  $346 - 197$   
 m.  $624 - 37$    n.  $766 - 643$    o.  $650 - 263$    p.  $221 - 165$   
 q.  $516 - 69$    r.  $647 - 208$    s.  $760 - 482$    t.  $352 - 188$

3. Give products :

$$16\frac{2}{3} \times 7\ell = 16\frac{2}{3}\ell \times 7 = \$\frac{1}{6} \times 7 = \$\frac{7}{6} = \$1.16\frac{2}{3}$$

- a.  $48 \times 16\frac{2}{3}\ell$    b.  $49 \times 16\frac{2}{3}\ell$    c.  $54 \times 16\frac{2}{3}\ell$    d.  $16\frac{2}{3} \times 7\ell$   
 e.  $48 \times 33\frac{1}{3}\ell$    f.  $49 \times 33\frac{1}{3}\ell$    g.  $96 \times 12\frac{1}{2}\ell$    h.  $12\frac{1}{2} \times 9\ell$   
 i.  $48 \times 12\frac{1}{2}\ell$    j.  $49 \times 12\frac{1}{2}\ell$    k.  $88 \times 37\frac{1}{2}\ell$    l.  $33\frac{1}{3} \times 8\ell$   
 m.  $48 \times 66\frac{2}{3}\ell$    n.  $49 \times 66\frac{2}{3}\ell$    o.  $69 \times 66\frac{2}{3}\ell$    p.  $66\frac{2}{3} \times 4\ell$   
 q.  $48 \times 83\frac{1}{3}\ell$    r.  $49 \times 83\frac{1}{3}\ell$    s.  $66 \times 83\frac{1}{3}\ell$    t.  $83\frac{1}{3} \times 5\ell$

4. Give answers :

$$31 + 16\frac{2}{3} \% = 31 + \frac{1}{6} = 31 \times 6$$

- a.  $16\frac{2}{3} \%$  of 126   b.  $126 \times 16\frac{2}{3}$    c.  $31 + 16\frac{2}{3} \%$   
 d.  $33\frac{1}{3} \%$  of 189   e.  $189 \times 33\frac{1}{3}$    f.  $43 + 33\frac{1}{3} \%$   
 g.  $12\frac{1}{2} \%$  of 168   h.  $168 \times 12\frac{1}{2}$    i.  $51 + 12\frac{1}{2} \%$   
 j.  $66\frac{2}{3} \%$  of 180   k.  $180 \times 66\frac{2}{3}$    l.  $60 + 66\frac{2}{3} \%$   
 m.  $83\frac{1}{3} \%$  of 120   n.  $120 \times 83\frac{1}{3}$    o.  $60 + 83\frac{1}{3} \%$



*Sight Problems*

1. A farmer sold 1600 bushels of rye at  $62\frac{1}{2}$  cents per bushel. (a) What did he receive for it? (b) How much less would it have brought if he had obtained only 62 ¢ per bushel? (c) How much more if the price were 63 ¢ per bushel?

2. A crop of 1250 bushels lost 1 % through various causes. (a) How many bushels were lost? (b) How many remained? (c) Find 99 % of 1250.

3. At an election A received 284 votes and B 147. (a) How many did both receive? (b) How many more did A receive than B?

4. What is the cost of 168 yards at  $62\frac{1}{2}$  ¢ per yard?

5. Find the number of square feet in a floor  $16\frac{2}{3}$  ft. wide and 24 ft. long.

6. (a) How many square yards in a roll of carpet 48 yd. long and  $\frac{3}{4}$  yd. wide? (b) How many yards of carpet  $\frac{3}{4}$  yd. wide will contain 48 sq. yd.? (c) What fraction of a yard is the width of a piece of carpet 16 yards long that contains 12 square yards? (d) What is the width of a piece of oilcloth 12 yards long that contains 16 square yards?

7. (a) At  $37\frac{1}{2}$  miles per hour, how far will a train go in 24 hours? (b) At  $37\frac{1}{2}$  miles per hour how long will a train require to go 1600 miles?

8. (a) How much cooked meat will 24 pounds of raw meat supply when 25 % of the weight of the latter is lost in cooking? (b) A hotel keeper needs 24 pounds of cooked meat. How many pounds must he get from the butcher to obtain this quantity, allowing for a loss of 25 % of its weight in cooking?

## Review — Adding Whole Numbers

### *Written Exercises*

1. The following are the monthly receipts of a butcher:  
 Jan., \$1646.28; Feb., \$1239.74; Mch., \$1735.95;  
 Apr., \$1596.87; May, \$1548.36; June, \$1463.88; July,  
 \$1356.48; Aug., \$1283.76; Sept., \$1495.89; Oct.,  
 \$1538.65; Nov., \$1605.67; Dec., \$1896.77.

Find the total for the year.

\$ 1646.28

1239.74

1735.95

1596.87

1548.36 80

1463.88 83

1356.48 etc.

1283.76 etc.

1495.89 etc.

1538.65 etc.

1605.67

1896.77

#### PROCESS

Adding upwards, think 14, 19, 28, 34, 42,  
 50, 56, 63, 68, 72, 80. Write 80.

Carrying 8, think 15, 21, 27, 35, 42, 46, 54,  
 57, 65, 74, 81, 83. Write 83, etc. When you  
 have written the total of the last column,  
 cover these totals with a strip of paper, and  
 write on the latter the totals of the columns,  
 adding downwards. Compare the two sets.  
 If they agree, write the result in its proper  
 place.

2. The accounts of a housekeeper show expenditures as follows during the year:

Rent, \$180; food, \$393.85; clothing, \$60.98; fuel and light, \$55.15; furniture, \$11.79; insurance, \$26.36; medical, \$38.61; contributions, \$10.36; recreation, \$7.68; reading, \$8.34; miscellaneous, \$60.71.

(a) What is the total for the year? (b) How much cash should she have on hand after paying all bills, if she receives \$20 per week, and deposits \$15 per month in the savings bank?

### "Side" Calculations

As a rule, business men omit superfluous figures. The writing of the total of each column in a long addition is, however, considered an advantage, inasmuch as the employment of these "side" totals makes it easier to locate a mistake in case of a discrepancy between the two footings.

3. Add horizontally and vertically :

$$a. \$3,486.59 + \$2,564.35 + \$1,957.83 = ?$$

$$b. \quad 769.94 + \quad 8,874.66 + \quad 396.64 = ?$$

$$c. \quad 1,999.87 + \quad 565.47 + \quad 2,877.69 = ?$$

$$d. \quad 2,538.65 + \quad 6,363.25 + \quad 655.58 = ?$$

$$e. \quad 656.48 + \quad 777.76 + \quad 3,996.86 = ?$$

$$f. \quad 3,075.93 + \quad 3,680.58 + \quad 693.47 = ?$$

$$g. \quad 395.76 + \quad 965.27 + \quad 879.68 = ?$$

$$h. \quad 6,425.39 + \quad 877.39 + \quad 3,572.77 = ?$$

$$i. \quad 595.73 + \quad 57.66 + \quad 1,483.94 = ?$$

$$j. \quad 1,867.58 + \quad 5,906.48 + \quad 68.77 = ?$$

---


$$k \quad + \quad l \quad + \quad m \quad = n$$

Find the sum of each of the lines,  $a-j$ . Find the sum of each of the columns,  $k-n$ . Test the result by covering ( $n$ ) with a piece of paper and writing on it the sum of  $k$ ,  $l$ , and  $m$ .

4. Add:

$$a. \quad 9,568,437 + \quad 534,652 + \quad 77,864 = ?$$

$$b. \quad 499,678 + \quad 6,647,889 + \quad 493,845 = ?$$

$$c. \quad 1,789,975 + \quad 274,676 + \quad 772,573 = ?$$

$$d. \quad 568,352 + \quad 523,858 + \quad 4,869,788 = ?$$

$$e. \quad 84,656 + \quad 1,846,095 + \quad 47,396 = ?$$

$$f. \quad 395,073 + \quad 656,757 + \quad 686,993 = ?$$

$$g. \quad 4,079,586 + \quad 93,876 + \quad 743,965 = ?$$

---


$$h \quad + \quad i \quad + \quad j \quad = k$$

# Multiplying Whole Numbers

## Written Exercises

1. At the rate of 459 rails per day, how many rails would be made by a factory in 328 days ?

PROCESS	TEST
459 rails	328
328	459 rails
<u>3672</u> product by 8 ones	<u>2952</u> product by 9 ones
14688 product by 32 tens	14760 product by 45 tens
Ans. <u>150,552</u> rails	Ans. <u>150,552</u> rails

2. Multiply. Test. Use only two partial products.

- |                     |                     |                     |
|---------------------|---------------------|---------------------|
| a. $357 \times 328$ | b. $426 \times 287$ | c. $284 \times 369$ |
| d. $637 \times 246$ | e. $273 \times 486$ | f. $364 \times 549$ |
| g. $568 \times 248$ | h. $459 \times 427$ | i. $324 \times 639$ |
| j. $279 \times 186$ | k. $164 \times 147$ | l. $183 \times 189$ |

3. How many square feet are there in a rectangular plot 864 ft. wide, 936 ft. long ?

PROCESS	TEST
864 (ft.)	936 (ft.)
936 (ft.)	864 (ft.)
<u>7776</u> Product by 9 hundreds	<u>7488</u> Product by 8 hundreds
31104 Product by 36 ones	59904 Product by 64 ones
Ans. <u>808704</u> (sq. ft.)	Ans. <u>808704</u> (sq. ft.)

4. Find products. Test.

- |                     |                     |                     |
|---------------------|---------------------|---------------------|
| a. $327 \times 972$ | b. $872 \times 756$ | c. $927 \times 749$ |
| d. $763 \times 436$ | e. $428 \times 856$ | f. $654 \times 945$ |
| g. $318 \times 963$ | h. $864 \times 735$ | i. $954 \times 642$ |
| j. $432 \times 936$ | k. $742 \times 824$ | l. $624 \times 832$ |

*Blackboard Exercises***Adding and Subtracting in one Operation**

1. A farmer's receipts for 1915 included \$4000.—  
 \$2134.91 for grain, \$298.74 for vegetables, 2134.91  
 \$134.80 for poultry, \$345.70 for hay, \$416 for 298.74  
 eggs, and \$362.76 for milk. How much less 134.80  
 than \$4000 were the receipts? 345.70  
 416.00

Write out the complete answer directly from the book. 362.76  
 See p. 97. 7.09

2. From the number at the top, deduct the sum of the other numbers. Write the answers directly from the book.

$$\begin{array}{r} a. \ 6758 \\ \underline{1234} \\ 869 \\ 475 \\ 2064 \\ \hline ? \end{array}$$

$$\begin{array}{r} b. \ 5643 \\ \underline{874} \\ 1065 \\ 398 \\ 627 \\ \hline ? \end{array}$$

$$\begin{array}{r} c. \ 9578 \\ \underline{3966} \\ 475 \\ 1357 \\ 818 \\ \hline ? \end{array}$$

$$\begin{array}{r} d. \ 7769 \\ \underline{876} \\ 3456 \\ 248 \\ 1459 \\ \hline ? \end{array}$$

**Multiplying and Adding**

3. What is the total weight of 9 bags of oats weighing 64 pounds each and a package of butter weighing 27 pounds?

**PROCESS**

$(64 \text{ lb.} \times 9) + 27 \text{ lb.} = 603 \text{ lb.}$  *Ans.* Think  $36 (9 \times 4)$ ; 43, adding 7. Write 3.

Think  $54 (9 \times 6)$ ; 58, carrying 4; 60, adding 2. Write 60.

4. Change the following mixed numbers to improper fractions. Write the answers directly from the book.

$$a. \ 9\frac{27}{84}$$

$$b. \ 8\frac{5}{36}$$

$$c. \ 12\frac{7}{15}$$

$$d. \ 23\frac{8}{9}$$

$$e. \ 64\frac{5}{8}$$

**Multiplying and Subtracting**

5. Of his crop of 603 bushels of oats a farmer has sold 9 loads of 64 bushels each. How many bushels remain?

**PROCESS**

603 bu.  $-(9 \times 64 \text{ bu.}) = 27 \text{ bu.}$  *Ans.*

Think 36 ( $9 \times 4$ ) and 7 (writing 7) are 43.

Think 54 ( $9 \times 6$ ), 58 (carrying 4), and 2 (writing 2) are 60.

6. Write only the answers:

a.  $160 - (7 \times 21)$     b.  $250 - (3 \times 71)$     c.  $330 - (7 \times 41)$

d.  $150 - (7 \times 19)$     e.  $250 - (3 \times 69)$     f.  $330 - (7 \times 39)$

7. At \$64 per acre, how many acres of land would cost \$603?

**PROCESS**

64)603

*Ans.*  $9\frac{7}{64}$  A.

Write 9 for the whole number in the quotient and 64 as the denominator of the fractional part. Think 36 ( $9 \times 4$ ) and 7 (writing 7 in the numerator) are 43; etc.

8. Write only the answers:

a.  $147)160$

b.  $213)250$

c.  $287)330$

d.  $21)160$

e.  $71)250$

f.  $41)330$

g.  $19)160$

h.  $69)240$

i.  $39)330$

j.  $\frac{160}{19} = 8\frac{?}{19}$

k.  $\frac{250}{69} = 3\frac{?}{69}$

l.  $\frac{330}{39} = 8\frac{?}{39}$

### Divisibility of Numbers

In reducing fractions to lower terms and in other forms of cancellation it is useful to be able to determine some numbers that are exact divisors of a given number.

When the division of one number by another gives a whole number for the quotient, the former number is said to be a *multiple* of the latter.

A number that is divisible by 2 is called an *even number*, and ends in 2, 4, 6, 8, or 0.

### Sight Exercises

1. State which of the following numbers is divisible by 2: *a.* 138. *b.* 217. *c.* 450. *d.* 1296. *e.* 2347.

A number is divisible by 3 when the sum of its digits is divisible by 3. By 9 when the sum of its digits is divisible by 9.

Thus 168 is divisible by 3 since  $1 + 6 + 8$  (15) is divisible by 3; 468 is divisible by 9 since  $4 + 6 + 8$  (18) is divisible by 9.

2. State which of the following numbers is divisible (i) by 2; (ii) by 3; (iii) by 9.

*a.* 84. *b.* 138. *c.* 217. *d.* 450. *e.* 774. *f.* 1296.

A number is divisible by 5 when it ends in 5 or 0.

3. State which of the following numbers is divisible (i) by 5; (ii) by 3; (iii) by 2; (iv) by 9.

*a.* 175. *b.* 225. *c.* 420. *d.* 375. *e.* 1760. *f.* 2004.

An even number that is divisible by 3 is divisible by 6.

A number is divisible by 4 or by 25 when its last two figures are ciphers, or are divisible by 4 or by 25.

4. State which of the following numbers is divisible (i) by 6; (ii) by 9; (iii) by 4; (iv) by 25.

*a.* 76050. *b.* 75060. *c.* 28200. *d.* 20820. *e.* 26820.

## Reducing Fractions

### *Sight Exercises*

1. Express in lowest terms :

$$\begin{array}{llllllll} a. \frac{24}{36} & b. \frac{40}{56} & c. \frac{15}{60} & d. \frac{17}{61} & e. \frac{22}{72} & f. \frac{25}{77} & g. \frac{25}{90} \\ h. \frac{25}{55} & i. \frac{24}{72} & j. \frac{48}{84} & k. \frac{25}{40} & l. \frac{36}{60} & m. \frac{42}{48} & n. \frac{75}{90} \end{array}$$

When the numerator of a fraction is a prime number, it cannot be reduced unless the denominator is a multiple of the numerator.

2. Reduce :

$$\begin{array}{llllll} a. \frac{29}{116} & b. \frac{17}{119} & c. \frac{23}{115} & d. \frac{13}{117} & e. \frac{37}{111} & f. \frac{53}{159} \\ g. \frac{19}{114} & h. \frac{41}{205} & i. \frac{31}{248} & j. \frac{47}{235} & k. \frac{61}{305} & l. \frac{43}{344} \end{array}$$

### *Sight or Written Exercises*

3. Reduce to lowest terms :

NOTE.—Examine each fraction as to the divisibility of both terms by 2, by 3, by 5, etc. Divide both terms by such number, and examine the new fraction in the same way.

$$\begin{array}{llllll} a. \frac{375}{1000} & b. \frac{168}{288} & c. \frac{160}{192} & d. \frac{147}{245} & e. \frac{250}{625} \\ f. \frac{875}{1000} & g. \frac{96}{216} & h. \frac{240}{600} & i. \frac{120}{288} & j. \frac{147}{196} \end{array}$$

### *Written Exercises*

1. Reduce  $\frac{161}{253}$  to lowest terms.

Since in this fraction a common factor is not readily found by inspection, use the method for finding the greatest common divisor given on page 138.

2. Express in lowest terms :

$$\begin{array}{llllll} a. \frac{78}{169} & b. \frac{85}{102} & c. \frac{76}{171} & d. \frac{145}{208} & e. \frac{115}{184} \\ f. \frac{93}{248} & g. \frac{185}{333} & h. \frac{123}{451} & i. \frac{172}{645} & j. \frac{235}{428} \end{array}$$



## Adding Mixed Numbers

*Written Exercises*

1. Find the total surface of six boiler plates containing respectively,  $2\frac{7}{9}$  sq. ft.,  $13\frac{1}{3}$  sq. ft.,  $25\frac{1\frac{3}{8}}{8}$  sq. ft.,  $7\frac{5}{6}$  sq. ft.,  $18\frac{1}{2}$  sq. ft., and  $\frac{3}{4}$  sq. ft.

		144	PROCESS
$2\frac{7}{9}$	16	112	Place in the first column the quotients of 144 by the denominators 9, 16, 6, and 4, respectively. Write in the second column the quotients of 144 by 3, and 2, respectively. In the second column write the product of each quotient in column one by the appropriate numerator.
$13\frac{1}{3}$	—	48	
$25\frac{1\frac{3}{8}}{8}$	9	117	
$7\frac{5}{6}$	24	120	
$18\frac{1}{2}$	—	72	
$\frac{3}{4}$	36	108	
<i>Ans.</i> $69\frac{1}{144}$ (sq. ft.)		$\frac{577}{144} = 4\frac{1}{144}$	

Use no figures other than those given above.

2. Add. Do not employ the extra column unnecessarily :

$$a. 16\frac{3}{16} + 5\frac{1}{9} + 12\frac{3}{4} + 8\frac{7}{12} + 32\frac{19}{8} + 1\frac{1}{24}.$$

		L. C. M.
2) 16 — 36 — 24	In finding the least common multiple omit the	
2) 8 — 18 — 12	denominators 9, 4, and 12, which are factors of	
2) 4 — 9 — 6	36.	
2 — 9 — 3		

$$b. 25\frac{1}{3} + 6\frac{3}{5} + 18\frac{3}{10} + 7\frac{1}{9} + 20\frac{1}{6} + 5\frac{7}{12}.$$

$$c. 10\frac{4}{7} + 6\frac{5}{12} + 20\frac{5}{8} + 3\frac{1}{4} + 13\frac{5}{6} + 3\frac{1}{3}.$$

$$d. 42\frac{3}{10} + 4\frac{2}{9} + 15\frac{1}{3} + 5\frac{2}{5} + 10\frac{1}{4} + 2\frac{5}{6}.$$

$$e. 39\frac{1}{2} + 6\frac{3}{7} + 16\frac{4}{9} + 7\frac{3}{16} + 15\frac{1}{3} + 3\frac{5}{8}.$$

# Review — Subtracting Mixed Numbers

## Preparatory Exercises

1. Give answers:

a.  $25 - 23 = ?$     b.  $25 + 17 - 23 = ?$     c.  $25 + 19 - 23 = ?$

How much more than 2 is the result in (a)? In (b)?

2. Subtract:

a.  $1 - \frac{2}{5} = ?$     b.  $1\frac{1}{2} - \frac{2}{5} = ?$     c.  $1\frac{1}{2} - \frac{2}{5} = ?$

In subtracting  $\frac{2}{5}$  from  $1\frac{1}{2}$  take  $\frac{2}{5}$  from 1, and to the result add  $\frac{1}{5}$ .

3. Give answers:

a.	40	b.	$40\frac{1}{2}$	c.	$40\frac{1}{2}$	d.	$40\frac{1}{2}$
	$- 39\frac{2}{5}$		$- 39\frac{2}{5}$		$- 39\frac{2}{5}$		$- 20\frac{2}{5}$

## Written Exercises

1. Mr. Newman's crop this year averaged  $165\frac{1}{2}$  bushels of potatoes to the acre. Last year it averaged  $147\frac{2}{3}$  bushels. What is the increase?

PROCESS			
		120	Take $\frac{1}{10}$ from 1, leaving $\frac{9}{10}$ . To
165 $\frac{1}{2}$	8	104	this add $\frac{2}{3}$ , which gives $\frac{12}{10}$ . This is
147 $\frac{2}{3}$	5	115	the difference between $1\frac{1}{2}$ and $\frac{1}{3}$ .
Ans. 17 $\frac{1}{6}$ (bu.)		1 $\frac{2}{3}$	

2. Find answers:

a.	200 $\frac{3}{4}$	b.	423 $\frac{1}{4}$	c.	164 $\frac{1}{2}$	d.	604 $\frac{1}{2}$
	$- 83\frac{9}{10}$		$- 234\frac{1}{8}$		$- 10\frac{7}{8}$		$- 345\frac{1}{12}$
e.	483 $\frac{1}{16}$	f.	722 $\frac{5}{6}$	g.	350 $\frac{3}{4}$	h.	890 $\frac{7}{8}$
	$- 60\frac{1}{12}$		$- 456\frac{2}{3}$		$- 75\frac{9}{10}$		$- 678\frac{9}{10}$

## Some Short Cuts

Some of the following methods may be used in testing a result obtained in the ordinary way.

*Written Exercises*

1. A merchant imported (a) 866 yards of dress goods  $\frac{7}{8}$  yd. ( $31\frac{1}{2}$  in.) wide; (b) 942 yards,  $\frac{8}{9}$  yd. (32 in.) wide. How many square yards were there in each lot?

## PROCESS

$$\begin{array}{r} (a) \quad 866 \times \frac{7}{8} \\ \underline{108\frac{1}{4}} \text{ Deduct } \frac{1}{8} \\ \text{Ans. } 757\frac{3}{4} \text{ (sq. yd.)} \end{array}$$

$$\begin{array}{r} (b) \quad 942 \times \frac{8}{9} \\ \underline{104\frac{2}{3}} \text{ Deduct } \frac{1}{9} \\ \text{Ans. } 837\frac{1}{3} \text{ (sq. yd.)} \end{array}$$

Cover the original results and test (a) by multiplying  $108\frac{1}{4}$  by 7, and (b) by multiplying  $104\frac{2}{3}$  by 8.

2. Multiply:

$$a. \quad 437 \times \frac{3}{4}$$

$$b. \quad 1946 \times \frac{6}{7}$$

$$c. \quad 1453 \times \frac{11}{12}$$

$$d. \quad 764 \times \frac{7}{8}$$

$$e. \quad 1875 \times \frac{8}{9}$$

$$f. \quad 2234 \times \frac{10}{11}$$

$$g. \quad 521 \times \frac{2}{3}$$

$$h. \quad 1744 \times \frac{5}{6}$$

$$i. \quad 2485 \times \frac{11}{12}$$

3. What is the cost (a) of 487 bushels of rye at  $79\frac{3}{4}\phi$ ? Of 565 bushels of wheat at  $99\frac{1}{8}\phi$ ?

## PROCESS

$$\begin{array}{r} (a) \quad 487 @ 79\frac{3}{4}\phi \\ \$389.60 @ 80\phi \\ \underline{1.21\frac{3}{4} @ \frac{1}{4}\phi} \\ \$388.38\frac{1}{4} \\ \text{Ans. } \$388.38 \end{array}$$

$$\begin{array}{r} (b) \quad 565 @ 99\frac{1}{8}\phi \\ \$565. - @ \$1 \\ \underline{.70\frac{5}{8} @ \frac{1}{8}\phi} \\ \$564.29\frac{3}{8} \\ \text{Ans. } \$564.29 \end{array}$$

(a) From 80 times 487 take  $\frac{1}{4}$  times 487.

(b) From 100 times 565 take  $\frac{1}{8}$  times 565.

## 4. Multiply :

a.  $867 \times 9\frac{2}{3}$

b.  $539 \times 39\frac{4}{5}$

c.  $1234 \times 99\frac{3}{4}$

d.  $943 \times 19\frac{3}{4}$

e.  $624 \times 59\frac{5}{8}$

f.  $2345 \times 49\frac{7}{8}$

5. How many yards of silk can be bought for \$250 when the price per yard is (a)  $\$2\frac{1}{2}$ ? (b)  $\$3\frac{1}{2}$ ? (c)  $\$5\frac{1}{2}$ ?

## PROCESS

(a)  $250 \times 1\frac{1}{2}$

$\underline{125}$  Add  $\frac{1}{2}$

Ans.  $\underline{375}$  (yd.)

(b)  $250 \times 1\frac{1}{3}$

$\underline{83\frac{1}{3}}$  Add  $\frac{1}{3}$

Ans.  $\underline{333\frac{1}{3}}$  (yd.)

(c)  $250 \times 1\frac{1}{5}$

$\underline{50}$  Add  $\frac{1}{5}$

Ans.  $\underline{300}$  (yd.)

(a) To divide by  $\frac{2}{3}$  multiply by  $\frac{3}{2}$ , or  $1\frac{1}{2}$ . (b) To divide by  $\frac{2}{3}$  multiply by  $\frac{3}{2}$ , or  $1\frac{1}{2}$ . (c) To divide by  $\frac{2}{5}$  multiply by  $\frac{5}{2}$ , or  $2\frac{1}{2}$ .

## 6. Divide :

a.  $849 \div \frac{3}{4}$

b.  $963 \div \frac{3}{4}$

c.  $747 \div \frac{3}{4}$

d.  $375 \div \frac{5}{8}$

e.  $490 \div \frac{5}{8}$

f.  $585 \div \frac{5}{8}$

g.  $512 \div \frac{7}{8}$

h.  $576 \div \frac{7}{8}$

7. How many yards of cloth can be bought for \$480 at the rate per yard of (a) \$1.50? (b)  $\$1.33\frac{1}{3}$ ? (c) \$1.25?

## PROCESS

(a)

$480 \times \frac{2}{3}$

$\underline{160}$  Deduct  $\frac{1}{3}$

$\underline{320}$  (yd.) Ans.

(b)

$480 \times \frac{3}{4}$

$\underline{120}$  Deduct  $\frac{1}{4}$

$\underline{360}$  (yd.) Ans.

(c)

$480 \times \frac{4}{5}$

$\underline{96}$  Deduct  $\frac{1}{5}$

$\underline{384}$  (yd.) Ans.

(a) To divide by  $1\frac{1}{2}$ , multiply by  $\frac{2}{3}$ ; (b) to divide by  $1\frac{3}{4}$ , multiply by  $\frac{4}{3}$ ; (c) to divide by  $1\frac{1}{5}$ , multiply by  $\frac{5}{4}$ , using the method given on the preceding page.

## 8. Find quotient :

a.  $849 \div 1\frac{1}{2}$

b.  $964 \div 1\frac{1}{3}$

c.  $745 \div 1\frac{1}{4}$

d.  $384 \div 1\frac{1}{5}$

e.  $847 \div 1\frac{1}{6}$

f.  $976 \div 1\frac{1}{7}$

g.  $747 \div 1\frac{1}{8}$

h.  $360 \div 1\frac{1}{9}$

*Sight Exercises*

1. If a factory consumes an average of  $121\frac{2}{5}$  tons of coal per month, how many tons will be required for two years?

PROCESS	
$121\frac{2}{5}$ T.	Think $4\frac{1}{5}$ ( $24 \times \frac{1}{5}$ ), or $9\frac{4}{5}$ . Write $\frac{4}{5}$ . Think
$\times 24$	24, 33 (carrying 9). Write 3. Think 48 (24
<u>Ans. <math>2913\frac{3}{5}</math> T.</u>	$\times 2$ ), 51 (carrying 3). Write 3: Think 24,
	29 (carrying 5). Write 29.

2. Write products directly from the book :

- |  |  |  |   |
|--|--|--|---|
| a. $138\frac{3}{8}$<br>$\times 8$<br><hr/> | b. $275\frac{5}{11}$<br>$\times 11$<br><hr/> | c. $328\frac{4}{7}$<br>$\times 7$<br><hr/> | d. $268\frac{2}{5}$<br>$\times 10$<br><hr/> |
| e. $348\frac{4}{9}$<br>$\times 9$<br><hr/> | f. $123\frac{3}{5}$<br>$\times 10$<br><hr/>  | g. $357\frac{7}{8}$<br>$\times 8$<br><hr/> | h. $210\frac{5}{8}$<br>$\times 16$<br><hr/> |
| i. $263\frac{1}{2}$<br>$\times 7$<br><hr/> | j. $301\frac{1}{5}$<br>$\times 13$<br><hr/>  | k. $234\frac{1}{9}$<br>$\times 9$<br><hr/> | l. $121\frac{1}{2}$<br>$\times 15$<br><hr/> |

3. Write quotients :

- |                       |                        |                       |                       |
|-----------------------|------------------------|-----------------------|-----------------------|
| a. $3)138\frac{3}{8}$ | b. $5)275\frac{5}{11}$ | c. $4)328\frac{4}{7}$ | d. $2)268\frac{2}{5}$ |
| e. $4)348\frac{4}{9}$ | f. $3)123\frac{3}{5}$  | g. $7)357\frac{7}{8}$ | h. $5)210\frac{5}{8}$ |
| i. $2)263\frac{1}{2}$ | j. $6)301\frac{1}{5}$  | k. $3)234\frac{1}{9}$ | l. $5)122\frac{1}{2}$ |

4. Write answers :

- |                                      |                                       |                                      |
|--------------------------------------|---------------------------------------|--------------------------------------|
| a. $\frac{1}{8}$ of $138\frac{3}{8}$ | b. $\frac{1}{5}$ of $275\frac{5}{11}$ | c. $\frac{1}{4}$ of $328\frac{4}{7}$ |
| d. $\frac{1}{2}$ of $268\frac{2}{5}$ | e. $\frac{1}{4}$ of $348\frac{4}{9}$  | f. $\frac{1}{3}$ of $123\frac{3}{5}$ |
| g. $\frac{1}{7}$ of $357\frac{7}{8}$ | h. $\frac{1}{5}$ of $210\frac{5}{8}$  | i. $\frac{1}{2}$ of $263\frac{1}{2}$ |
| j. $\frac{1}{6}$ of $301\frac{1}{5}$ | k. $\frac{1}{3}$ of $234\frac{1}{9}$  | l. $\frac{1}{5}$ of $122\frac{1}{2}$ |

*Written Exercises*

1. What is the cost of  $1422\frac{2}{3}$  yards of calico at  $6\frac{1}{2}$  cents per yard?

PROCESS

$$\begin{array}{r} 1422\frac{2}{3} \\ \times .06\frac{1}{2} \\ \hline 8536 \\ 711\frac{1}{3} \\ \hline \$92.47\frac{1}{3} \text{ Ans.} \end{array}$$

When the fractional part of the mixed number used as a multiplier has a unit numerator, do not change mixed numbers to improper fractions. To 6 times  $1422\frac{2}{3}$  add  $\frac{1}{3}$  of  $1422\frac{2}{3}$ .

2. Find products. Do not change mixed numbers to improper fractions.

a.  $138\frac{2}{3}$   
 $\times 8\frac{1}{3}$   

---

b.  $275\frac{5}{11}$   
 $\times 11\frac{1}{5}$   

---

c.  $328\frac{4}{7}$   
 $\times 7\frac{1}{4}$   

---

d.  $268\frac{2}{5}$   
 $\times 10\frac{1}{2}$   

---

e.  $348\frac{4}{5}$   
 $\times 9\frac{1}{4}$   

---

f.  $123\frac{3}{5}$   
 $\times 10\frac{1}{3}$   

---

g.  $357\frac{7}{8}$   
 $\times 8\frac{1}{7}$   

---

h.  $210\frac{5}{8}$   
 $\times 12\frac{1}{6}$   

---

i.  $263\frac{1}{3}$   
 $\times 7\frac{1}{2}$   

---

j.  $301\frac{1}{5}$   
 $\times 13\frac{1}{6}$   

---

k.  $234\frac{1}{9}$   
 $\times 9\frac{1}{3}$   

---

l.  $122\frac{1}{2}$   
 $\times 15\frac{1}{5}$   

---

3. Add the following:

$24\frac{1}{3}$ ,  $6\frac{1}{4}$ ,  $39\frac{1}{7}$ ,  $48\frac{2}{3}$ ,  $7\frac{2}{3}$ ,  $84\frac{2}{3}$ .

Combine  $\frac{1}{3}$  and  $\frac{2}{3}$ ,  $\frac{1}{4}$  and  $\frac{3}{4}$ . Write  $\frac{4}{7}$  ( $\frac{1}{7} + \frac{3}{7}$ ) and carry 2 to the whole numbers.

4. Find sums:

a.  $6\frac{1}{2}$   
 $10\frac{3}{4}$   
 $18\frac{2}{5}$   
 $23\frac{1}{6}$   
 $9\frac{1}{8}$   
 $42\frac{1}{2}$   

---

b.  $20\frac{1}{8}$   
 $26\frac{1}{6}$   
 $14\frac{1}{2}$   
 $24\frac{5}{8}$   
 $8\frac{1}{4}$   
 $7\frac{1}{8}$   

---

c.  $12\frac{3}{5}$   
 $6\frac{1}{6}$   
 $5\frac{4}{7}$   
 $8\frac{2}{5}$   
 $16\frac{1}{3}$   
 $94\frac{2}{7}$   

---

d.  $36\frac{2}{5}$   
 $17\frac{4}{6}$   
 $9\frac{2}{5}$   
 $38\frac{5}{6}$   
 $\frac{1}{5}$   
 $23\frac{1}{8}$   

---

e.  $6\frac{5}{8}$   
 $20\frac{7}{12}$   
 $12\frac{2}{5}$   
 $8\frac{5}{12}$   
 $10\frac{1}{5}$   
 $6\frac{1}{5}$   

---

*Sight Problems*

1. If a post 5 ft. high casts a shadow of 4 ft., how high is a tree whose shadow is 40 ft. ?

2. Find the cost of 7 pounds of sugar at the rate of 19 cents for  $3\frac{1}{2}$  pounds.

3. At 3 for 5 cents, how much will be paid for 36 oranges ?

4. If a baseball club wins 4 games out of every 7 played, how many games will they win out of 70 ?

5. The election returns continue to show a majority for A of about 317 in every 100 districts ; about how great a majority should he receive in a state containing 1000 districts ?

6. If there are rations sufficient to last 1000 soldiers for 64 days, how long should they last 2000 soldiers ?

7. When it requires 80 men to do a piece of work in 17 days, how many men would it take to do the work in 34 days ?

8. When 4.5 yd. cloth cost \$11, how many yards can be bought for \$44 at the same rate ?

9. If the interest on \$200 for a year is \$12, what is the interest for a year on \$600 ?

10. What will be the cost of 39 baskets at the rate of \$3 for a "baker's dozen," thirteen baskets ?

11. If 64 horses eat 84 bushels of oats per week, how many horses will eat 21 bushels (a) in a week ? (b) In 2 weeks ?

12. In order to make his stock of hay last 8 weeks, a farmer sells 6 cows. If he kept all his cows, the hay would have lasted only 4 weeks. How many cows did he have originally ?

*Written Problems*

1. When a fence 6 ft. high casts a shadow of  $4\frac{1}{2}$  ft., how high is a tree whose shadow at the same time is  $31\frac{1}{2}$  ft. in length?

2. What is the cost of  $24\frac{1}{2}$  pounds at the rate of 19¢ for  $3\frac{1}{2}$  pounds?

3. At the rate of 50¢ for 13 boxes of sardines, what would be paid for  $6\frac{1}{2}$  doz. boxes?

4. If a baseball club wins 51 games out of 96 played, how many victories would there be in 32 games at the same rate?

5. A's majority in 342 districts is 273. What will be the majority in 1140 districts if the rate continues the same?

6. If there are rations for 1500 soldiers for 9 weeks, how many days will they last if the garrison is increased by 600 men?

NOTE. — How many men would there be in the increased garrison?

7. When 81 men are required to do a piece of work in 32 days (a) how many men are needed to do it in 24 days? (b) How many additional men?

8. How many yards of cloth can be bought for \$47 at the rate of \$11.75 for  $3\frac{3}{4}$  yards?

9. If the amount of \$250 for a year is \$265, what is the amount of \$250 for 2 years? What is the interest for 1 yr.? For 2 yr.?

10. Find the cost of 39 doz. baskets at the rate of \$3.75 for 13 baskets.

11. What fraction of his cows must a farmer sell to make his stock of feed last  $1\frac{1}{3}$  times as long as it would if he kept them all?



**Business Forms**

Copy the following letters, etc. :

1.

24 RAILROAD AV.

MARICOPA, ARIZ.

July 11, 1916

MESSRS. DENNIS & POLAND

41 Park Row

Tucson, Ariz.

*Gentlemen*

*Kindly deliver at your earliest convenience the following articles selected by Mrs. Nostrand last week :*

*1 Roll Axminster Carpet*

*1/2 doz. Oak Chairs*

*2 Rockers*

*4 Brussels Rugs*

*1 Dining Table*

*Send bill at once, making the usual cash discount, and I will mail check immediately.*

*Yours*

GEO. E. NOSTRAND

2.

<div data-bbox="841 1096 906 1117" data-label="Text"><p>STAMP</p></div> <div data-bbox="337 1223 753 1259" data-label="Text"><p><i>Messrs. Dennis &amp; Poland</i></p></div> <div data-bbox="473 1271 681 1306" data-label="Text"><p><i>41 Park Row</i></p></div> <div data-bbox="585 1321 695 1353" data-label="Text"><p><i>Tucson</i></p></div> <div data-bbox="717 1370 846 1411" data-label="Text"><p><i>Arizona</i></p></div>
--

3.

41 PARK ROW

TUCSON, ARIZ.

July 12, 1916

GEORGE E. NOSTRAND, Esq.

24 Railroad Av.

Maricopa, Ariz.

*Dear Sir*

*Yours of the 11th inst. is at hand. The order has received our best attention, and the goods will be delivered to-day.*

*Please find bill inclosed, discounted as you request.*

*Awaiting your further orders, we are*

*Yours respectfully*

DENNIS &amp; POLAND

A letter should contain the address of the sender and the address of the person to whom it is sent.

4.

TUCSON, ARIZ., July 12, 1916

MRS. GEO. E. NOSTRAND

24 Railroad Av.

Maricopa, Ariz.

*Bought of* DENNIS & POLAND

FURNITURE, CARPETS, ETC.

41 Park Row

36 yd. Carpet	\$ 1.50	54	—	
$\frac{1}{2}$ doz. Chairs	18.—	9	—	
2 Mahogany Rockers	6.25	12	50	
4 Brussels Rugs	2.50	10	—	
1 Dining Table		45	—	
		130	50	
		13	05	
	Less 10 %			
				\$ 117 45

**Business Forms**

5.

24 RAILROAD AV.

MARICOPA, ARIZ.

July 13, 1916

MESSRS. DENNIS &amp; POLAND

41 Park Row

Tucson, Ariz.

*Gentlemen**Inclosed please find check for One Hundred Seventeen and 45/100 Dollars, in settlement of accompanying bill.**Kindly receipt the latter and return it to**Yours truly*

GEO. E. NOSTRAND

6. Check :

No. 863

MARICOPA, ARIZ., July 13, 1916

**THE FARMERS AND DROVERS NATIONAL BANK**

Pay to the order of

*Dennis & Poland**One Hundred Seventeen*  $\frac{45}{100}$  DOLLARS.\$117  $\frac{45}{100}$ *George E. Nostrand*

7.

41 PARK ROW

TUCSON, ARIZ.

July 14, 1916

GEORGE E. NOSTRAND, Esq.

24 Railroad Av.

Maricopa, Ariz.

*Dear Sir**Your favor of the 13th inst., with accompanying check, is at hand. We return receipted bill herewith.**Trusting that the goods will prove satisfactory, we remain**Yours sincerely*

DENNIS &amp; POLAND

*Written Exercises*

1. Make out bills for the following purchases supplying names, dates, etc. :

(a) 32 yd. Pongee at \$ .25	(b) $\frac{1}{2}$ doz. Spoons at \$4.50
2 Sweaters at \$3.50	2 Carvers at \$0.75
$\frac{1}{2}$ doz. Collars at \$1.50	$1\frac{1}{2}$ doz. Knives \$1.50
3 pr. Blankets at \$2.75	3 Salt Cellars at \$0.28
less 5 %	less 10 %

2. Make out a check for \$15 as a payment of part of bill (a), dated the day after the purchase. Use the name of a local bank.

3. Give credit on bill (a) for the amount of the check, with the date.

4. Make out a receipt on account for the amount of the check.

5. Write a check for the balance of bill (a), dated a week later than the first check.

6. Receipt bill (a).

7. Make out a receipt for the amount of the check sent in settlement of bill (a).

8. Make out a check for bill (b).

9. Write a receipt in full for this amount.

10. Receipt bill (b).

11. Make out the bill of a mechanic for materials furnished and 3 days' work at prevailing rates.

12. Write a letter ordering the goods in (a) or (b).

13. Address the envelope for the foregoing letter, following the form on page 238, writing the name of the state without abbreviation.

## The Day Book

In the *day book* kept by Madden & Bristol, all transactions with customers having accounts, are entered as they occur. Ordinary petty sales for cash are omitted, the total of these being kept by means of the cash register, etc.

The following are extracts from pages of Madden & Bristol's day book:

September 27, 1916				Dr.	Cr.
169	Cornelius Watson, Cr.				
	By 24 lb. Butter .27	6.48			
	" 6 doz. Eggs .18½	<u>1.11</u>			7 59
	— " —				
45	Alexander S. Ferris, Dr.				
	To 5 bbl. Flour 5.75		28 75		
	— 28 —				
169	Cornelius Watson, Dr.				
	To Cash		20 —		
	— 29 —				
213	James E. Sullivan, Dr.				
	To 48 lb. Butter .30		14 40		
	— " —				
169	Cornelius Watson, Dr.				
	To 100 lb. Coffee .28	28.—			
	150 " Sugar .06	9.—			
	15 " Tea .40	6.—			
	4 yd. Mull .29½	<u>1.18</u>	44 18		
	— 30 —				
25	M. Mullaly				
	By 100 bbl. Flour	5.40			540 —

At a convenient time the bookkeeper "posts" the foregoing accounts in the ledger, writing the ledger page in the first column to show that the account is posted.

### The Ledger

Cornelius Watson, a farmer, makes purchases from Madden & Bristol, and supplies them with farm produce. When he calls to settle his account, the bookkeeper refers to page 169 of the *ledger*, which shows the following entries, posted from the day book :

DR.					CORNELIUS WATSON					CR.	
<u>1916</u>					<u>1916</u>						
Sept.	7	To Mdse	18	68	Sept.	8	By Mdse	24	80		
	14	" "	24	59		10	" "	6	45		
	21	" "	32	49		11	" "	5	60		
	28	" Cash	20	—		15	" "	12	30		
	29	" Mdse	44	18		18	" "	32	—		
						27	" "	7	59		
						30	" Balance	51	15		
			<u>139</u>	<u>89</u>				<u>139</u>	<u>89</u>		
Oct.	1	To Balance	51	15	Oct.	2	By Cash	20	—		
							" Mdse	15	40		

In addition to the accounts of persons to whom Madden & Bristol sell goods and from whom they make purchases, their ledger contains a Cash account, in which are entered all receipts and disbursements of money ; a Merchandise account ; an Expense account, in which are entered payments for rent, clerk hire, etc. ; an account with *themselves*, from which they obtain a knowledge of the condition of their business as to its profit or loss.

The farmer that desires to know the profits realized from various sources, keeps a crop account, a dairy account, a poultry account, etc.

Sometimes he keeps a day book, in which he enters the number of hours of work done on the different crops, purchases, sales, etc.

*Written Exercises*

1. Make out the bill of Madden & Bristol for the goods purchased by Cornelius Watson on Sept. 30.
2. Copy the following monthly statement rendered by Madden & Bristol, Sept. 29, 1916.

## MONTHLY STATEMENT

MISSOULA, NEB., Sept. 30, 1916

MR. CORNELIUS WATSON

IN ACCOUNT WITH MADDEN &amp; BRISTOL

GENERAL MERCHANDISE

1914		Dr.			
Sept.	7	To Bill rendered	18	63	
	14	" " "	24	59	
	21	" " "	32	49	
	28	" Cash	20	—	
	29	" Bill rendered	44	18	139 89
		Cr.			
Sept.	8	By Mdse	24	80	
	10	" "	6	45	
	11	" "	5	60	
	15	" "	12	30	
	18	" "	32	—	
	27	" "	7	59	88 74
Sept.	30	Due us			\$ 51 15

In the monthly statement are omitted the details of goods delivered and received, especially when a bill has been rendered at the time of each purchase, or a slip given.

3. Make out the account of Madden & Bristol as it would appear in the ledger kept by Cornelius Watson.

In this the items appearing as credits in the ledger of Madden & Bristol would be entered on the debit side of Mr. Watson's ledger, and *vice versa*.

4. Make out a monthly statement rendered by Mr. Watson, Sept, 30.

5. Calculate the profit shown by the following account.

Dr.		Field No. 1 — 20 Acres Potatoes				Cr.			
Mar.	15	Seed, 80 bags	\$ 4.50		Sept.	16	2400 bu.	.75	
Apr.	20	Fertilizer, 15 T.	25.00			25	1250 "	.77	
		Spraying, 20 A.	6.00			30	900 "	.78	
		Labor, 180 da.	1.50		used		57 "	.75	
		Horse, 260 "	.75		Oct.	15	300 "	.80	
		Rent, 20 A.	5.00						
Oct.	15	Net Profit							

6. A farmer received \$1344.72 from a 13-acre field of potatoes. Find the balance after deducting expenses as follows :

9 $\frac{3}{4}$  tons of Fertilizer @ \$35  
 $\frac{1}{10}$  ton of Plaster @ \$10  
 37 bbl. Seed Potatoes @ \$3  
 7 bbl. Seed Potatoes @ \$2.75  
 28 lb. Paris Green @ \$.22  
 Labor (man) 125 days @ \$1.25  
 Labor (horse) 140 days @ \$.75

7. (a) How much butter is made from 3360 pounds of fat, if the weight of the latter is increased  $\frac{1}{8}$  by the water and salt contained in the butter? How many pounds of milk (b) containing 3 $\frac{1}{5}$ % of fat will yield the foregoing quantity? (c) Containing 5 $\frac{1}{4}$ % of fat?

8. (a) If it costs a farmer 35¢ per ton per mile, what does it cost him to deliver 1400 bushels of wheat to a railroad station 4 miles from the farm? (b) What will he save on 1400 bushels when the cost is reduced to 20¢ per ton per mile by the improvement of the roads?

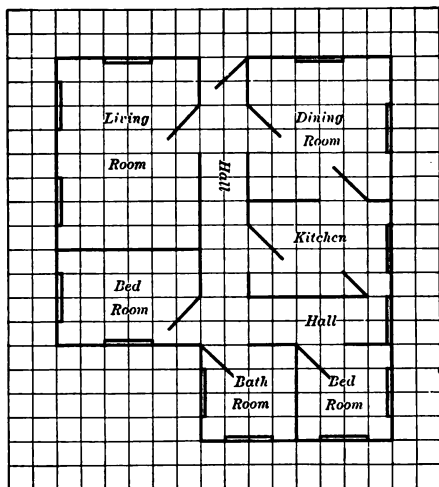


## SECTION IV

### SUPPLEMENTARY AND REVIEW

#### Planning a House.

Mr. Kirby wishes to build a 6-room house for a summer residence. He makes the following diagram of the floor,



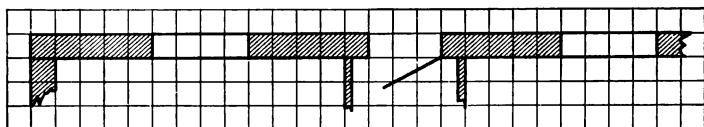
using cross-ruled paper, the distance between the lines representing 2 feet. The location of the windows is shown by double lines.

#### *Oral Exercises*

1. What are the dimensions of the floor of (a) the living room? (b) The dining room? (c) The kitchen? (d) The bathroom? (e) The large bedroom? (f) The small bedroom?
2. Give the area of the floor of each room.
3. (a) What is the width of the hall? How long is (b) the front hall? (c) The side hall?
4. If the outer walls are 1 foot thick and the inner ones (the partitions) 6 inches thick, what is (a) the extreme width of the house? (b) Its greatest depth?

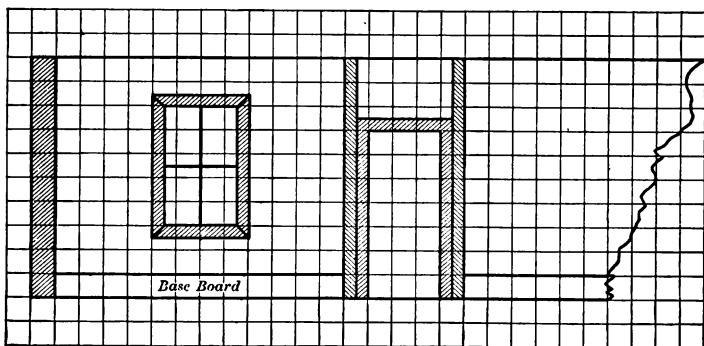
**Drawing to Scale***Written Exercises*

1. Draw the floor plan showing the thickness of the walls and of the partitions. Indicate the location of a window by the omission of the shading and that of a door by leaving the proper opening, using an oblique line to denote the direction in which the door opens. Insert chimneys and closets where you think they are needed.



If cross-ruled paper is used, represent 1 foot by the distance between the lines.

2. On a larger scale draw the floor plan of the kitchen locating the chimney, the stove (or range), the sink, and one or two closets.



3. Copy and complete the above portion of the front elevation of the interior, showing the thickness of the walls and of the partitions, the location of the windows and of the door. Show the paneling of the door.

## Furnishing the House

*Written Exercises*

After building the house Mr. Kirby has \$600 to spare for the equipment. Mrs. Kirby apportions \$560 of this sum as shown below, retaining \$40 for emergencies. Make out a list of the articles she can purchase with this money. The following items are suggested. Supply omissions, and insert the cost of each article.

1.	<i>The Living Room</i>	\$100
Book case	Rocker	Window shades
Desk	Arm rocker	Curtain hooks
Desk chair	Rug	Curtain poles
Center table	Curtains	Shades
Pictures	Sofa	Chairs
Clock	Stove	Books
Phonograph	Records	Sundries
2.	<i>The Dining Room</i>	\$160
Buffet	Pictures	Cutlery
China closet	Rug	Spoons, etc.
Extension table	Window shades	Water jug
Serving table	Curtains	Tumblers
2 Arm chairs	Rods and hooks	Cruets
4 Chairs	Dinner set	Flower vase
Stove	Clock	Napkins
Tray	Call bell	Sundries
3.	<i>The Kitchen</i>	\$110
Stove	Chairs	Glassware
Table	Clock	Tinware
Shade	Linoleum	Dishes
Picture	Towels	Freezer
Refrigerator	Bread box	Sundries

4. *Bedroom* \$100

Dresser	Large Bed	Pillows
Chiffonier	Spring	Blankets
Rocker	Mattress	Spread
Comforter	Sheets	Pillow slips
Shades	Curtains	Lounge
Chairs	Rod and Hooks	Matting
Rugs	Pictures	Sundries

5. *Bedroom* \$50

2 Beds (single)	Springs	Pillows
Dresser	Mattresses	Blankets
Rocker	Sheets	Spreads
Chairs	Curtains	Pillow slips
Shades	Rod and hooks	Matting
Rugs	Pictures	Sundries

6. *The Bathroom* \$20

Medicine chest	Mirror	Towels
Toilet articles	Bath rug	Sundries

7. *The Halls* \$20

Hat rack	Mat	Towels
Picture	Table	Sundries

8. Using a convenient scale, draw a rectangle representing  $100' \times 150'$ . Draw the outline of the house as nearly as possible in the center of the plot.

9. Draw an elevation of the front wall of the classroom, locating the baseboard, the doors, the blackboard, etc.

10. Make a scale drawing of the school lot, and locate on it the building.

11. Taking the surface of each window as  $5' \times 3'$ , compare the window space of each room with its floor space.

## Some Household Problems

*Written*

1. A 2-gallon pail of water with the vessel weighs 20 pounds. (a) When 10 pails are used 3 times a day for meals and 20 pails for other purposes, how many pounds must be handled to bring the water into the house, and (b) how many to carry it out again? (c) Carrying one pail at a time, how far must a person travel in bringing it from a well 40 feet from the kitchen and disposing of the waste water in a drain 30 feet distant?

2. (a) What is the cost of bringing water into a farmhouse at a cost of \$25 for a pump, \$40 for a gasoline engine, \$20 for a tank, \$42 for bathroom equipment, \$4 for an extra basin, 8¢ per foot for 500 feet of pipe, \$15 for a kitchen sink, \$4 for valves, \$60 for labor, etc.? (b) At 6%, what is the yearly interest on the cost? (c) How much less than 5¢ is the daily interest at 7%?

3. A pupil in a millinery class used for her hat 4 yards of ribbon at 45¢, 6 bunches of flowers at 85¢, and 16 yards of straw braid at  $12\frac{1}{2}$ ¢. (a) How much did the material cost? (b) What would be the cost of the hat at a store, if the milliner charged \$3.50 for making, and added 40% to the cost of the materials? (c) What did the girl save by doing the work in her spare time?

4. Each pupil in a sewing class made a white skirt containing  $1\frac{1}{2}$  yd. cambric @  $12\frac{1}{2}$ ¢,  $2\frac{3}{4}$  yd. embroidery @ 10¢, 1 piece feather trimming @ 10¢. (a) Find the cost of the material for each, including 3 papers of pins @ 24¢ per dozen,  $1\frac{1}{2}$  doz. spools of cotton @ 38¢ per dozen, and 200 needles @  $10\frac{1}{2}$ ¢ per 100, used in making 4 doz. skirts. (b) How much would the manufacturer

charge per dozen, if he added 25% for labor and profit?  
(c) What would be the price in a store if  $33\frac{1}{3}\%$  were added to the manufacturer's price?

5. The class also made 50 Marguerites, each containing  $2\frac{1}{4}$  yd. nainsook @ 15¢, 4 yd. lace trimming at 6¢,  $1\frac{1}{2}$  yd. ribbon @ 2¢. Find the cost per dress including pins, needles, cotton, etc., as given in problem 4.

6. What does a girl average per week if she receives \$27 per week for 17 weeks, \$17 per week for 13 weeks, and is idle 22 weeks?

7. The goods in a suit cost \$1.05, and the buttons, etc., 15¢. The cost of the labor was 50% of that of the material. The manufacturer's expenses added 50% to the price of the labor and material. (a) What was the cost to the manufacturer? (b) If he sold a suit at an advance of 50%, what did he receive for it?

8. A man, who has saved \$400, borrows \$600 from a loan association and buys a house for \$1000. His taxes are \$10 per year and he spends \$20 per year for repairs. (a) How much does he spend in six years including \$10 per month to the association? (b) If the monthly payments pay off the loan in six years, how much will he have paid as interest?

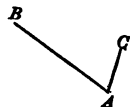
9. A boy earned \$8 per week during his first 26 weeks in business and put 50 cents in bank each week. He then received an increase of 25% in wages and increased his deposits 30%. How much had he in bank at the end of the year?

10. A girl earning \$8 per week, contributed \$3 weekly to the family support, put 25¢ per week in the bank, spent 10¢ for car fare and 15¢ for lunch for 300 days. How much had she for clothing, etc., for the year?

## Lines and Angles

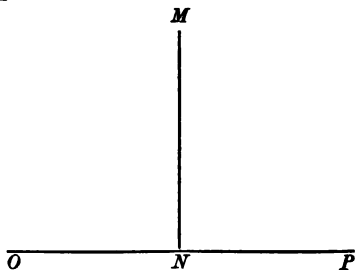
The lines  $AB$  and  $XY$ , which will not meet no matter how far they are prolonged, are said to be parallel.

The lines  $BA$  and  $CA$  which meet at  $A$ , form an *angle*.

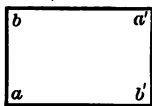


The line  $HI$  forms two angles at  $I$  with the line  $KJ$ . When these are unequal, each is called an *oblique* angle; when they are equal, as at  $N$ , each is called a *right* angle, and  $MN$  is said to be *perpendicular* to  $OP$ .

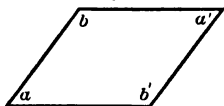
An angle smaller than a right angle  $HIK$ , for instance, is called an *acute* (sharp) angle; one larger than a right angle  $HIJ$ , for instance, an *obtuse* (blunt) angle.



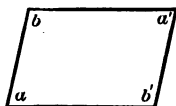
## Angles of a Parallelogram



RECTANGLE



RHOMBOIDS



A parallelogram containing four right angles is called a *rectangle*; one containing four oblique angles is called a *rhomboid*. The opposite angles of a rhomboid are equal;  $a$  and  $a'$ ,  $b$  and  $b'$ . Two of them are acute and two are obtuse.

## Areas of Rhomboids

*Preparatory Exercise*

From a strip of paper 4 inches wide cut several rhomboids, having bases measuring 6 inches each. Show that each is equivalent in area to a rectangle 6 in. by 4 in.

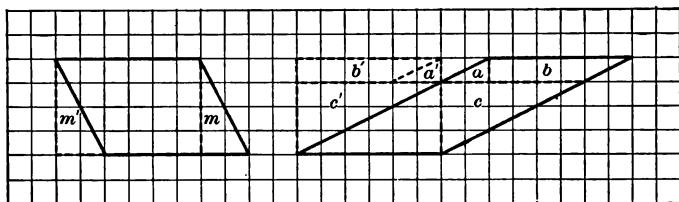


FIG. 1

FIG. 2

SUGGESTION. — Cut off triangle  $m$ , and place at  $m'$ . Cut off  $a$ ,  $b$ , and  $c$ ; and place at  $a'$ ,  $b'$ , and  $c'$ .

*Sight Exercises*

1. What is the perpendicular distance between the bases?
2. If the rhomboid shown in Fig. 1 is divided into two triangles by a diagonal ending in the lower right corner, (a) what is the area of each? How long is (b) the base of each? (c) The perpendicular?

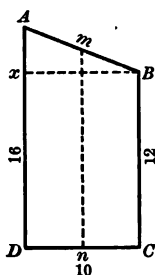
A triangle having all of its angles acute is called an *acute-angled* triangle; one containing an obtuse angle, is called an *obtuse-angled* triangle.

3. (a) In what direction must a diagonal be drawn to divide the rhomboid shown in Fig 1 into two obtuse-angled triangles? (b) Taking the lower horizontal side of the rhomboid as the base of one triangle, what line measures the perpendicular? (c) Does this line lie within the triangle?



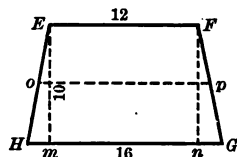
### The Trapezoid

A quadrilateral that has only two parallel sides is called a *trapezoid*.



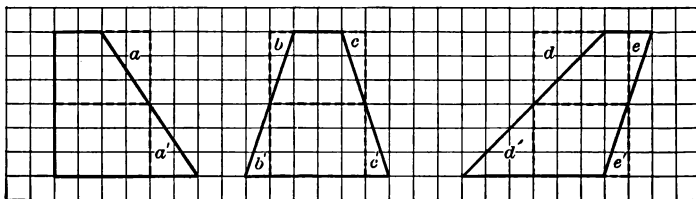
1.  $ABCD$  represents one end of a shed 16' high in the front, 12' high in the back, and 10' deep. Draw  $Bx$  parallel to  $DC$ . (a) What are the dimensions of the rectangle  $xBCD$ ? (b) Its area? (c) What are the dimensions of the right triangle  $ABx$ ? (d) Its area? (e) What is the area of the end of the shed? (f) What is the average height,  $mn$ ?

2.  $EFGH$  represents a tapering sheet of tin, 16 inches long at the bottom, 12 at the top, and 10 inches wide. (a) What is the area of the rectangle  $EFnm$ ? (b) Of the right triangle  $EmH$ ? (c) Of  $FnG$ ? (d) Of  $EFGH$ ? (e) What is the length of  $op$ , the average length of the strip?



### Areas of Trapezoids

3. From paper 6 in. wide cut several trapezoids, each having an upper base of 2 in. and a lower base of 6 in. Show that each is equivalent to a rectangle 6 in. by 4 in.



Cut off triangle  $a'$  and place at  $a$ , cut off  $b'$ , and place at  $b$ , etc.

*Sight Exercises*

1. (a) What is the perpendicular distance between the parallel sides of each trapezoid? (b) What is the half sum of the parallel sides?

2. What are the dimensions (a) of  $a$  and  $a'$ ? (b) Of  $b$  and  $b'$ ? (c) Of  $c$  and  $c'$ ? (d) Of  $d$  and  $d'$ ? (e) Of  $e$  and  $e'$ ? (See diagram on p. 254.)

*Area of trapezoid =  $\frac{1}{2}$  Sum of parallel sides  $\times$  Perpendicular distance between them.*

3. Find the number of square feet in the side of a hen house 7' high in front, 5' in the back, and 12' long.

4. A tapering board is 6'' wide at one end, 12'' wide at the other, and 16' long. How many square feet are there in its surface?

5. Find the areas of the following trapezoids:

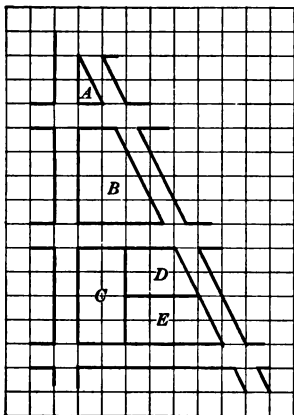
- (a) Parallel sides 20 yd. and 30 yd. Perpendicular 16 yd.
- (b) Parallel sides 40 rd. and 50 rd. Perpendicular  $33\frac{1}{2}$  rd.
- (c) Parallel sides 10 in. and 15 in. Perpendicular 24 in.
- (d) Parallel sides 30 ft. and 50 ft. Perpendicular 20 ft.
- (e) Parallel sides 30 yd. and 42 yd. Perpendicular  $16\frac{2}{3}$  yd.

A quadrilateral having no parallel sides is called a *trapezium*.

**Polygons**

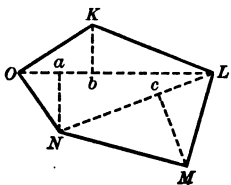
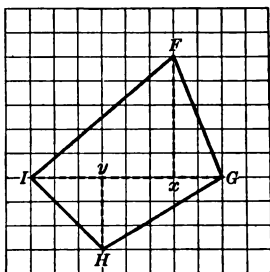
A plane figure bounded by straight lines is a *polygon*.

A polygon having five sides is called a *pentagon*, one having six sides a *hexagon*, one having eight sides an *octagon*, etc.

*Written Exercises*

The accompanying diagram is drawn on a scale of 400 feet to the inch.

1. (a) What are the dimensions of block *A*? (b) What is its area?
2. (a) What are the respective lengths of the parallel sides of block *B*? (b) What is the perpendicular distance between them? (c) What is the area of the block?
3. What is the perpendicular distance between the parallel sides (a) of plot *D*? (b) Of plot *E*? (c) Of the entire block?
4. Find the area (a) of the block. (b) Of plot *C*. (c) Of plot *D*. (d) Of plot *E*.
5. (a) Find the number of square rods in the plot *FGHI* when *IG* measures 24 rods, *Fx* 15 rods, and *yH* 9 rods. (b) What is the area in acres and a decimal?



6. To determine the area of the 5-sided field *KLMNO*, the following lines are measured: *OL*, 28 rods; *NL*, 24 rods; *Kb*, 8 rods; *Na*, 10 rods; and *Mc*, 12 rods. How many square rods are there in the field?

**Board Measure***Preparatory Exercises*

The back of a henhouse is 12 ft. long and 12 ft. high.

1. How many square feet are there in its surface?
2. How many boards, each 12 ft. long, will be required when the boards are (a) 12 inches wide? (b) 6 inches wide? (c) 8 inches wide?
3. How many square feet will be covered by a board (a) 12 ft. long, 12 in. wide? (b) 12 ft. long, 8 in. wide? (c) 12 ft. long, 6 in. wide?

Lumber is sold by the *board foot*, which means a piece of wood 1 foot long, 1 foot wide, and 1 inch thick. A piece 1 foot long, 1 foot wide, and 2 inches thick contains 2 board feet. Boards less than 1 inch thick are assumed to have a thickness of an inch.

*To find the number of board feet in a piece of lumber multiply the number of feet in its length by the number of feet in its width by the number of inches in its thickness.*

*Sight Exercises*

Give the number of feet in each of the following boards, planks, joists, etc., measuring as follows:

1.  $16' \times 6'' \times 3''$  ( $16 \times \frac{1}{2} \times 3$ )
2.  $10' \times 12'' \times 2''$  ( $10 \times 1 \times 2$ )
3.  $18' \times 8'' \times 4''$  ( $18 \times \frac{2}{3} \times 4$ )
4.  $16' \times 12'' \times \frac{7}{8}''$  ( $16 \times 1 \times 1$ )
5.  $12' \times 8'' \times 6''$
6.  $12' \times 6'' \times 8''$
7.  $14' \times 6'' \times 2''$
8.  $16' \times 6'' \times 3''$
9.  $12' \times 6'' \times 3''$
10.  $12' \times 4'' \times 4''$

**Industrial Applications***Sight Problems*

1. When a carpet is 27 inches wide (a) what is its width in feet and inches? (b) In feet and a fraction? (c) In the fraction of a yard?

2. If it required 8 strips of carpet  $2\frac{1}{4}$  ft. wide to cover the floor of a square room, (a) how wide is the room? (b) What is the length in feet? (c) In yards? (d) How many yards long is each strip?

3. When a grass plot is 30 yards square and a mowing machine cuts a strip  $\frac{3}{4}$  yard wide (a) how many such strips will there be in the plot? (b) How long is each strip? (c) How far would a boy walk in mowing 1 strip? (d) Excluding the distance required to make the turns, how many feet would a boy travel in mowing 40 strips?

4. If a plow turns a strip (furrow)  $1\frac{1}{2}$  feet wide, (a) how many such strips will there be in a field 1500 feet square? (b) How long is each strip (furrow)?

5. If a mowing machine cuts a strip  $4\frac{1}{2}$  ft. wide, how many such strips will there be (a) in a field 900 feet wide? (b) In a field 300 yards wide?

6. If a floor is 8 yards long, 6 yards wide, (a) which way can a carpet be laid to cover the floor without splitting a strip when the carpet is  $\frac{3}{4}$  yard wide? (b) How many strips will be required? (c) How long is each strip? (d) How many yards of carpet will it take?

7. How many square feet are there in a furrow  $1\frac{1}{2}$  ft. wide, 6000 ft. long?

8. How many feet long must a furrow be to contain 9000 sq. ft. when it is  $1\frac{1}{2}$  ft. wide?

9. How many square feet are there in a strip 2000 ft. long and  $4\frac{1}{2}$  ft. wide?

10. How many feet long must a strip be to contain 18,000 sq. ft., when the strip is  $4\frac{1}{2}$  ft. wide?

11. How wide must a strip be in order that 2000 ft. of the strip will contain 9000 sq. ft.?

12. If a boy mows a plot 30 feet square by cutting strips forward and backward, how many times does he turn at the ends when the machine cuts a 30-inch strip?

13. Since 10 cubic feet of water became 11 cubic feet of ice, (a) how many cubic feet of ice will 30 cubic feet of water make? (b) How many cubic feet of water will result from the melting of 88 cubic feet of ice?

14. A cubic foot of water weighs 1000 ounces; what does a cubic foot of ice weigh?

15. If 6 men can plow a field in 4 days, how long will it require 8 men to do it?

16. When  $\frac{2}{3}$  of a ship is worth \$4000, what is  $\frac{5}{6}$  of it worth?

17. If a captain has food enough to last his crew of 10 people for 4 days, how long would it last 8 people?

18. If there are provisions for 10 men for four days, how much longer would they last if there were 2 men fewer?

19. A plank contains 27 board feet. It is 1 in. thick and 18 in. wide. How long is it?

20. If a boy spends  $1\frac{3}{4}$  hours per night in study, how many minutes does he study in 5 nights?

21. How many more half hours are there in January than in June?

22. How many days are there from May 15 to June 15?

23. At 50 cents per hour, how much does a man receive in a week if he works 5 hours on Saturday and 8 hours each of the other five days?

24. How many half pint glasses of lemonade are there in  $7\frac{1}{2}$  gallons?

25. What is the cost of a cubic yard of stone at 8¢ per cu. ft.?

26. When a shingle covers  $4'' \times 4''$ , how many shingles will cover a square foot?

27. What fraction (*a*) of a shingle 16" long is covered by the upper layers when 4" is exposed? (*b*) Of a shingle 18" long?

28. A barrel of lime containing  $2\frac{1}{2}$  bu. costs \$1.05. What is the price per bushel?

29. A barrel containing potatoes weighs 170 lb., the barrel itself weighs 20 lb. At 60 lb. to the bushel, how many bushels of potatoes are in the barrel?

30. How many cubic feet of concrete are there in a sidewalk 200 ft. long, 6 ft. wide, when the concrete is 4 in. thick?

31. At 75¢ per load, how many loads of sand will cost \$39?

32. How many square yards are there in the ceiling of a room 30 ft. long, 24 ft. wide?

33. How many square yards are there in the walls of a room 30 ft. long, 24 ft. wide, 9 ft. high?

34. How many yards of carpet  $\frac{3}{4}$  yard wide will contain 60 square yards?

35. At 75¢ per square yard what will be the cost of plastering the walls and the ceiling of a room containing 160 sq. yd.?

*Written Problems*

1. How many cubic feet of ice are contained in a rectangular pond 880 ft. long, 300 ft. wide, when the ice is 16 inches thick?

2. Since 10 cubic feet of water are increased by freezing to 11 cubic feet of ice, how many cubic feet of water will make a pile of ice measuring 880 ft. by 300 ft. by  $1\frac{1}{8}$  ft.?

3. At the rate of 11 cubic feet of ice to 625 lb., find the weight in tons of the ice in a rectangular pond 880 ft. by 300 ft., when the ice is 16 inches thick.

4. If ice 16 inches thick on a pond 880 feet long, 300 feet wide is placed in a pile 100 ft. long, 88 ft. wide, how high will the pile be?

$$\text{Height in feet} = \frac{1\frac{1}{8} \times 880 \times 300}{100 \times 88}.$$

5. If  $\frac{11}{16}$  of a schooner is worth \$13,200, what is the value of  $\frac{5}{8}$  (10 sixteenths) of it?

6. A commander has sufficient provisions to last his 1200 men 27 days. (a) How many men could he keep for 30 days? (b) How many of his 1200 men must he send away in order that he may have sufficient food to last 3 days longer than the original 27 days?

7. A rectangular field contains 27 acres. It is 96 rods long. How wide is it?

$$27 \times 160 \div 96.$$

8. If a boy spends  $1\frac{3}{4}$  hours per night in study for 5 nights per week, in how many weeks will he have spent 105 hours in study?

9. How many half days are there from May 15 to Dec. 24?



10. At 8¢ per cubic foot what will be the cost of the stone required to build a wall 66 ft. long, 6 ft. high,  $1\frac{1}{2}$  ft. thick, if the stone is  $\frac{1}{12}$  of the wall?

11. At  $16\frac{1}{2}$  cu. ft. to the ton, how many tons of stone will be required for a wall 4 rd. (66 ft.) long, 2 yd. (6 ft.) high, 18 in. ( $1\frac{1}{2}$  ft.) thick, when  $\frac{1}{12}$  is deducted for the space occupied by the mortar?

Indicate operations. Cancel.

12. At 50 cents per hour how much does a man earn in 365 days, working 5 hours on each of 52 Saturdays and 8 hours on the remaining days excluding 52 Sundays and 5 holidays?

13. How much surface will be covered by 1000 cypress shingles each 18 in. long, 4 in. wide, if only  $\frac{1}{4}$  of the length of each shingle is exposed, the remainder being covered by the shingles above it?

14. Make out a bill for the construction of a wall, the cost of materials and labor being as follows:

$16\frac{1}{2}$ cu. ft. stone	@ 8¢
$\frac{3}{4}$ bu. lime	@ 42¢
$\frac{1}{5}$ load sand	@ 75¢
Mason $2\frac{3}{4}$ hr.	@ \$4.80 per day of 8 hours.
Helper $1\frac{3}{4}$ hr.	@ \$1.60 per day of 8 hours.

15. If a broker's commission for selling cotton is \$5 per 100 bales of 500 pounds each, what fraction of the price does he receive when cotton is selling at  $12\frac{1}{2}$ ¢ per pound?

16. A coffee broker is paid \$10 for selling 250 bags of coffee weighing 130 pounds each. What fraction of the price does he receive when coffee is selling for  $6\frac{1}{2}$ ¢ per pound?

17. In 15 days 51 men receive a certain sum in wages. How many men will earn the same sum in 17 days?

18. If I lend a man \$180 for 3 months, how long should he lend me \$120 in return?

19. In a library there were 3600 volumes last year. This year there are 3750. What per cent is the increase?

20. (a) When a man's wages are increased from \$900 to \$1350 per year, what is (a) the fraction of increase? (b) The per cent? (c) If the wages fell off from \$1350 to \$900, what would be the fraction of decrease? (d) The per cent?

21. A blackboard contains 2 square yards. It is  $4\frac{1}{2}$  ft. long. How wide is it?

22. A can do  $\frac{1}{10}$  of a piece of work in a day, B can do  $\frac{1}{12}$  of it in a day, and C can do  $\frac{1}{15}$  of it in a day? What part of it can all three together do in a day? How long would it take the three together to do the work?

23. At 21 bricks to the cubic foot, find (a) the number of bricks required for a wall 50 ft. long, 40 ft. high, 12 in. thick. (b) Find the cost of the bricks at \$8 per M.

24. (a) How many square feet are there in the front of a house 25 feet wide, 40 feet high, deducting for 1 door  $8' \times 3'$  and 8 windows, each  $6' \times 3'$ ? (b) For how many square yards would a painter charge if he allowed only one half the space occupied by the door, windows, etc.?

25. How many boxes of glass, each containing 50 sq. ft., are required for 10 windows, each  $6'$  by  $3'$ , if 12 in. are deducted from each dimension for the space taken by the frames, sashes, etc.?

26. (a) How many double rolls of paper 16 yd. long, 18 in. wide would be required for a wall 24 ft. long, 9 ft. high? (b) What would be the cost of hanging the paper at 15 cents per single roll?

### Some Applications of Percentage — Commission

A person that buys or sells or collects money for another is called an *agent*, and the fee received for his services is called his *commission*. The commission is frequently a certain percentage of the sum involved.

A person that buys land, grain, etc., for another is frequently called a *broker* and his commission is sometimes called *brokerage*. An agent that sells produce for a farmer is called a *commission merchant*.

### *Sight Problems*

1. What does an agent receive for collecting a debt of \$450, when his rate of commission is 2%?
2. A real estate agent sells a house for \$5000. What is his commission at 5% on \$1000 and  $2\frac{1}{2}\%$  on the remainder?
3. A broker buys 1000 barrels of flour at \$6 for which he receives a commission of  $\frac{1}{8}$  of 1%. What is his commission on the purchase?
4. If an agent deducts  $2\frac{1}{2}\%$  commission for collecting a debt of \$600, what sum does he remit to his employer?
5. Find the commission at 2% for selling 100 cases of eggs of 30 doz. each, which brought 20 cents a dozen.
6. The gross proceeds of a sale of berries were \$500. The deductions are 4% commission and \$10 charges. Give the net proceeds that are remitted to the shipper.
7. What brokerage is charged for buying 120 shares of stock, \$100 each, at  $\frac{1}{8}\%$ ?
8. What does an agent receive for collecting 75% of a debt of \$400, at 2% commission?

*Written Exercises*

1. Copy and complete the following statement rendered by a commission merchant to a farmer who shipped goods to be sold on commission :

ROCHESTER, WIS., May 15, 1916

MR. JOHN MADDEN,  
De Bruce, Wis.

*In account with* SEAVER BROS.  
COMMISSION MERCHANTS

37 Market Square

		CR.				
<i>April</i>	6	<i>By 25 bu. Potatoes</i>	.60	15	—	
	15	<i>" 50 " "</i>	.58			
	24	<i>" 60 doz. Eggs</i>	.10			
	30	<i>" 120 bu. Potatoes</i>	.61			
<i>May</i>	8	<i>" 60 doz. Eggs</i>	.11 $\frac{1}{2}$			
	14	<i>" 100 bu. Potatoes</i>	.60			
		DR.			\$	(a)
<i>April</i>	25	<i>To Freight, Cartage, etc.</i>	(c)			
<i>May</i>	15	<i>" Commission 5 %</i>	(b)			
	15	<i>" Check in full</i>		172	94	
					\$	(a)

2. Write out the check of Seaver Brothers on a Rochester Bank for the balance remitted to Mr. Madden.

3. An agent collected 75 % of a debt of \$ 420. How much does his employer receive when the commission of 3 $\frac{1}{2}$  % is deducted from the sum collected ?

4. Find the fee received for the sale of a farm for \$ 16,500 at the rate of 5 % on \$ 1000, 2 $\frac{1}{2}$  % on \$ 4000, and 1 % on the remainder.

### Taxes

The money required for the maintenance of schools, for the construction and repair of roads, for salaries of officials, etc., is obtained from the people in the form of *taxes*.

In some sections a tax of \$1 or \$2 is collected from every male resident. This is called a *poll* tax. Other taxes are levied on property.

A special tax, sometimes called an *assessment*, is levied upon property immediately benefited by a road, a sewer, etc., to pay the cost of its construction. A school tax is sometimes made a special tax on property lying within the school district.

The amount of taxes payable by the owner of property is based upon the value of the property as determined by public officers, called *assessors*. This *assessed value* is nearly always below the real value of the property.

The rate of taxation may be stated as a per cent of the assessed value, as so many mills per dollar, as so many dollars per \$1000, etc.

### Sight Exercises

1. What per cent is (a) 1 cent on the dollar? (b) 5 mills on \$1? (c) 12 mills on \$1?
2. What per cent is (a) \$2 on \$100? (b) \$1.50 on \$100? (c) 75¢ on \$100?
3. What rate per cent is (a) \$5 on \$100? (b) \$25 on \$1000?
4. At  $\frac{3}{4}$  of 1%, what are the taxes on property assessed at \$1200?
5. Property worth \$8000 is assessed at 75% of its value. What are the taxes at  $1\frac{1}{2}$ % of the assessed value?

### Commercial Discount

In catalogues of their goods manufacturers and dealers affix prices much above those at which the goods are actually sold. The former are called *list*, or catalogue, prices, which are subject to a *trade discount*.

Thus an article that is "listed" by the manufacturers at \$.60, may be subject to a discount of 40 %, which makes the price to the dealer \$.36. When the manufacturer determines to sell at a lower rate, he announces an additional discount, say 16 $\frac{2}{3}$  %, which is taken on \$.36, making the new rate to dealers \$.30.

The rates of discount are specified in a circular called a *discount sheet*, a new one being issued whenever a change in the price is made.

Whenever two successive discounts are specified, one is "based" on the list price, and the other is "based" on the price remaining after the first is deducted.

Thus in a bill of silverware listed at \$ 600, subject to discounts of 33 $\frac{1}{3}$  and 10 %, the discounts are taken as follows :

	\$ 600	or	\$ 600	
Less $\frac{1}{3}$	<u>200</u>		Less $\frac{1}{6}$	<u>60</u>
	\$ 400			\$ 540
Less $\frac{1}{6}$	<u>40</u>		Less $\frac{1}{3}$	<u>180</u>
Net	\$ 360		Net	\$ 360

it being immaterial in which order the discounts are taken. There may be any number of successive discounts.

In writing successive discounts, the per cent mark is written with only the last.

Commercial discounts include trade discount and cash discount. The latter is an allowance for payment before it is due.

## Cash Discount

CHICAGO, ILL., Feb. 18, 1915

THE MERIDEN SILVER PLATE CO.

483-9 Lakeside Av.

Sold to MR. JOHN R. THOMPSON

Marion, Ind.

Terms: 60 days, Cash 10 da. 5%.

Feb.	14	20 doz. Spoons	\$4.50	90	—		
	16	30 " Forks	5.—	150	—		
				240	—		
		Less $33\frac{1}{3}\%$		80	—		
				160	—		
		Less 10 %		16	—	144	—
Feb.	15	15 Tureens	\$8.—	120	—		
		Less 25 %		30	—		
				90	—		
		Less 15 %		13	50	76	50
						220	50
		Cash 5 %				11	02
		Recd. payment				\$209	48
		Feb. 25, 1915					
		Meriden S. P. Co.					
		per J. P. M.					

By the terms of the bill, a credit of 60 days is allowed, subject to a discount of 5 % if payment is made before the expiration of 10 days from the date of the bill.

The footing gives the amount due as \$220.50 unless the bill is paid by Feb. 28. As it is settled on the 25th, the cash discount of 5 % is deducted from the above amount.

*Written Exercises*

1. Make out a bill in the foregoing form for the following purchases :

30 doz. Spoons at \$4.80 per dozen, less  $33\frac{1}{3}$  and 10 %.

10 doz. Knives at \$5.20 per dozen, less 25 and 10 %.

24 doz. Forks at \$5.40 per dozen, less  $33\frac{1}{3}$  and 10 %.

18 Plated Trays at \$7.50 each, less 25 and 20 %.

Supply dates, name of buyer and of seller, and bring all the purchases within 10 days of the payment of the bill. Deduct 5 % for cash and receipt the bill.

2. Make out a check for the net amount of the bill.

3. Write out the receipt given by the seller of the goods.

4. Find the net cost of a bill of hardware amounting at list prices to \$256, (a) with discounts of 40 and 10 % ; (b) with discounts of  $33\frac{1}{3}$  and 25 %.

## PROCESS

(a)	\$ 256.00	
40 %	<u>102.40</u>	
	153.60	
10 %	<u>15.36</u>	
Net	\$ 138.24	Ans.

(b)	\$ 256.	
25 %	<u>64.</u>	
	192.	
$33\frac{1}{3}$ %	<u>64.</u>	
	\$ 128.00	Ans.

(a) 40 % of \$256 is obtained by multiplying \$256 by .4, writing the first figure of the product one place to the right. 10 % of \$153.60 is obtained by writing the first four figures of this number, placing the first figure of the discount under the second figure of the base.

NOTE. — Successive discounts may be taken in any order.

(b) As 256 is a multiple of 4 and not of 3, 25 % is first deducted.



5. A dealer bought furniture listed at \$400, with discounts of 20 and 10 %. He sold it for the list price. (a) What is his profit? (b) What per cent of \$400 did he gain? (c) What per cent of the cost did he gain?

6. Find the net cost of the following :

- |  |                           |
|--|---------------------------|
| a. \$500 less $33\frac{1}{3}$ and 10 % | b. \$180 less 25 and 20 % |
| c. \$600 less 40 and 10 %              | d. \$240 less 30 and 5 %  |
| e. \$700 less 30 and 20 %              | f. \$360 less 10 and 10 % |
| g. \$800 less 50 and 30 %              | h. \$240 less 20 and 20 % |
| i. \$900 less 40 and 40 %              | j. \$540 less 15 and 5 %  |

7. What is the difference between a discount of  $43\frac{1}{3}$  % on \$600 and successive discounts of  $33\frac{1}{3}$  % and 10 %? Which rate is better for a buyer?

8. Find the difference between \$400 less 20 and 20 %, and \$400 less 30 and 10 %.

9. A quantity of hardware bought for \$400 less 25 and 10 % is sold at 35 % above cost. What is the selling price?

10. A man had \$10,000. By the end of the first year he had spent 10 % of it. During the second year he spent 10 % of the remainder. During each of the next two years he spent 10 % of what remained from the preceding year. (a) What remained at the end of the fourth year? (b) What did he spend in four years? (c) How much more did he spend in the first year than in the fourth?

11. At the end of 1915, a city had a population of 10,000. During 1916 it increased 10 %. In each of the next three years the population increased 10 % over the population of the year before. (a) What was the increase in four years? (b) What per cent was the population of 1919 greater than that of 1915?

**Gain or Loss**

The gain or the loss on the sale of an article is frequently expressed as a per cent of its cost.

*Sight Problems*

1. A grocer buys coffee at 25 ¢ per pound, and sells it at an advance of 20 %. (a) How many cents does he gain on each pound? (b) What is the selling price?

2. A dry goods merchant buys silk at \$1 per yard and sells it at 80 ¢. (a) What is his loss per yard? (b) What per cent of the cost does he lose?

3. A dealer in shoes sold a pair for \$2.50 on which he gained 50 ¢. (a) What did they cost? (b) What per cent of the cost is 50 ¢?

4. A dealer sells a knife for \$1, on which his profit is 25 %. (a) What fraction of the cost is \$1? (b) What is the cost?

5. (a) What per cent is lost on a horse sold for \$200, which was \$50 below cost?

(b) What per cent is gained on a horse sold for \$200, which was \$50 above cost?

6. (a) What was the cost of a cow sold for \$30, if the loss was 25 % of the cost?

(b) What was the cost of a cow sold for \$30, if the gain was 25 %?

7. (a) What fraction of the cost is a gain of  $33\frac{1}{3}$  %?  
(b) What fraction of the selling price is a gain of  $33\frac{1}{3}$  %?  
(c) What fraction of the selling price is a loss of  $33\frac{1}{3}$  %?

8. If a merchant's sales are \$3000 and his profits are \$1000, what per cent does he gain (a) on the cost of the goods? (b) On his receipts?

9. If a man's sales are \$3000 and his rate of gain is 50 %, (a) what fraction of \$3000 is his gain? (b) What per cent?

(c) If a merchant's sales of damaged goods are \$3000 and his rate of loss is 50 %, what per cent of \$3000 is his loss?

10. A man's pay is increased from \$20 per week to \$24. (a) By what fraction is it increased? (b) By what decimal? (c) By what per cent?

11. After a boy has increased his stock of marbles  $\frac{1}{4}$  he has 60 marbles. How many had he originally?

12. After a girl has given away 25 % of her cherries, she has 60 left. How many had she at first?

13. (a) What number increased by  $\frac{1}{4}$  of itself is equal to 15? (b) What number diminished by  $\frac{1}{4}$  of itself is equal to 15?

14. At \$8 per M, what is the cost of 12,500 bricks?

15. Give in square feet the area of a door 7 ft. 6 in. by 2 ft. 8 in.

16. How many panes of glass  $1\frac{3}{4}$  ft. long, 1 ft. wide, will make 50 sq. ft.?

17. At  $62\frac{1}{2}$  lb. to the cubic foot, how many cubic feet of water will weigh a ton?

18. How many cubic feet are removed in digging a cellar 40 ft. long, 20 ft. wide, 10 ft. deep?

19. If clay in carts occupies 20 % more space than it did before digging, how many cubic feet in carts will equal 8000 cubic feet dug out of a cellar?

20. At 20 cubic feet to a cart load, how many loads will there be in 10,000 cubic feet?

*Written Problems*

1. After selling 175 bushels of wheat a farmer still has 350 bushels remaining of this year's crop. What per cent of the crop did he sell?
2. After buying 120 acres of land a farmer has 600 acres. By what per cent did he increase the original size of the farm?
3. When a pupil has read 285 of the 300 pages in her book, (a) what per cent of the book has she read? (b) What per cent remains?
4. If oranges are bought at 25 cents a dozen and sold at the rate of 2 for 5 cents, what per cent is gained?
5. Stockings costing 25 cents per pair are sold at the rate of 3 pairs for a dollar. What per cent of the cost is the profit?
6. Dress goods costing  $33\frac{1}{3}$  cents a yard are damaged and sold at 25 cents a yard. What per cent of the cost is lost?
7. Apples bought at 2 for 3 cents are sold at 2 for 5 cents. Find the gain per cent.
8. A man sells a calf for \$15.00 by which he gains \$2.50. What per cent of the cost is the gain?
9. A man sold a pig for \$15 by which he lost \$2.50. What per cent of the cost was the loss?
10. A village had a population last year of 210. The population is now 252. What is the increase per cent?
11. Last year a village had a population of 252. The population this year is 210. What is the loss per cent?
12. Of a school of 150 pupils 144 are present. (a) What is the per cent of attendance? (b) What is the per cent of absence?

13. A bale of cotton bought at  $9\frac{3}{4}\phi$  per pound is sold for  $10\frac{1}{4}\phi$  per pound. What per cent is gained?

14. (a) What is the profit on a bale of cotton weighing 400 pounds bought at  $9\frac{3}{4}\phi$  per pound and sold at  $10\frac{1}{4}$  cents per pound? (b) What per cent is gained?

15. When a grocer gains 4 % by selling sugar at  $6\frac{1}{2}$  cents per pound, (a) what is the cost of the sugar per pound? (b) What is his profit on a barrel containing 300 pounds? (c) What is his percentage of profit on the sale of a barrel of sugar?

16. If a farmer raises 325 bushels of wheat this year on the same number of acres as produced only 250 bushels last year, what is the per cent of increase?

17. A builder sold a house for \$2520, by which he made a profit of \$420. (a) What % did he gain? (b) What fraction of the selling price did he gain?

18. A man sold a house for \$2520 and by so doing lost  $\frac{1}{5}$  of what it cost him. What did he pay for the house? What fraction of the selling price is equal to his loss?

19. A grocer sold a quantity of coffee for \$3600, one-sixth of this amount being profit. What per cent did he gain on the cost of the coffee?

20. (a) What per cent does a boy make on 60 peaches bought at 3 for 2 cents and sold at 2 for 3 cents? (b) What per cent is made on an article bought at  $\frac{3}{4}\phi$  and sold for  $\frac{3}{2}\phi$ ? (c) On one bought at  $\frac{4}{6}\phi$  and sold for  $\frac{3}{6}\phi$ . (d) On one bought at \$4 and sold for \$9?

21. (a) If a man's gain is  $\frac{1}{5}$  of the cost of his goods, what fraction is it of the selling price? (b) If a man's gain is 25 % of the selling price, what per cent is it of the cost?

### Comparing Numbers

Five ball players have made batting scores as follows :

A has made 16 hits out of 45 times at bat.

B has made 11 hits out of 30 times at bat.

C has made 14 hits out of 40 times at bat.

D has made 15 hits out of 42 times at bat.

E has made 13 hits out of 36 times at bat.

These records might be expressed in the fractional form thus :

A,  $\frac{16}{45}$ ; B,  $\frac{11}{30}$ ; C,  $\frac{14}{40}$ ; D,  $\frac{15}{42}$ ; E,  $\frac{13}{36}$ .

For purposes of comparison, the decimal form is simpler :

A, .355 $\bar{5}$ ; B, .366 $\bar{6}$ ; C, .35; D, .357 $\bar{1}$ ; E, .361 $\bar{1}$ .

In the employment of the decimal form in baseball averages, each is written as thousandths, fractions in the fourth place below  $\frac{1}{2}$  being rejected. If the fraction is  $\frac{1}{2}$  or higher, the decimal in the third place is increased by 1. The scores would then appear :

A, .356; B, .367; C, .350; D, .357; E, .361.

While the decimal point is always written in connection with these records, the word *thousandths* is generally omitted in speaking of them, the record of C being stated as three-fifty. If they are given as percents, they should be written :

A, 35.6%; B, 36.7%; C, 35.0%; D, 35.7%; E, 36.1%;

being read 35 and 6 tenths per cent, etc. C's record is 35%, but the cipher is printed for the sake of uniformity.

### Written Problems

1. Find the records, in thousandths, of the following players :

PLAYERS	AT BAT	HITS	PLAYERS	AT BAT	HITS
M	60	22	N	90	34
O	75	27	P	66	24
Q	48	18	R	54	19

2. Carry out to tenths (a) the percentage of increase in the population of a village which had 450 inhabitants last year and now has 475. (b) The percentage of decrease if the population has fallen from 475 to 450.

3. Which city shows the greater percentage of increase; M, which grew in a year from 12,000 to 12,689; or N, which, during the same period, grew from 15,000 to 15,860? Give the rate of increase for each.

4. A merchant's sales were \$150,000 in 1914, \$190,000 in 1915, and \$230,000 in 1916. What was the rate of increase (a) for 1915 over 1914? (b) For 1916 over 1915? (c) For 1916 over 1914?

5. A merchant's sales fell off from \$230,000 to \$190,000 one year, and from \$190,000 to \$150,000 the next year. What was the rate of decrease each year?

6. The receipts of grain in a certain city during a week were: wheat, 7250 bu.; corn, 7810 bu.; oats, 4315 bu.; rye, 6230 bu.; barley, 1475 bu.; buckwheat, 420 bu. What per cent of the total did each kind constitute?

PROCESS				
		RATE	RATE	RATE
Wheat	7,250 bu. ÷ 27,500 =	26.36 %	26.4 %	26 %
Corn	7,810 bu. ÷ 27,500 =	28.4	28.4	28
Oats	4,315 bu. ÷ 27,500 =	15.69	15.7	16
Rye	6,230 bu. ÷ 27,500 =	22.65	22.6	23
Barley	1,475 bu. ÷ 27,500 =	5.37	5.4	5
Buckwheat	420 bu. ÷ 27,500 =	1.53	1.5	2
Total	27,500 bu. ÷ 27,500 =	100.00 %	100.0 %	100 %

Obtain the rate for each by dividing its quantity by the total. Carry it out in the first result to two decimal places. If the answer is required in *one* decimal place, increase the tenths' figure by 1 in three of the rates to make the total 100 when the hundredths' figures are rejected. Thus, change 26.36 to 26.4, 15.69 to 15.7, and 5.37 to 5.4, taking the three having the largest figure in hundredths' place. If the answer is required in whole numbers, increase the ones' place of three of the rates by 1, as in the last column.

7. Kentucky contains 40,000 square miles of land and 400 square miles of water; what is the per cent of each?

## Interest

*Preparatory Exercises*

Frank Carroll has borrowed \$2000 from Peter H. De Nyse. As evidence of the debt Mr. Carroll gives the latter his *promissory note* as follows:

*Joliet, Ill., March 8, 1914*

*On demand I promise to pay to the order of*  
*----- Peter H. De Nyse -----*  
*Two Thousand  $\frac{00}{100}$  ----- Dollars*  
*Value received, with interest at 6%.*  
*\$ 2000  $\frac{00}{100}$  Frank Carroll*

*Sept. 8, 1914*  
*Received interest sixty*  
*dollars.*  
*P. H. De Nyse.*

*March 8, 1915*  
*Received interest sixty*  
*dollars. Cash on %*  
*four hundred dollars.*  
*P. H. De Nyse*

The *indorsements* show two semi-annual payments of interest and a reduction of the debt by the payment of \$400.

*Sight Exercises*

1. How much interest is payable on the new principal Sept. 8, 1915?

2. Give interest as follows:

	PRINCIPAL	RATE	TIME		PRINCIPAL	RATE	TIME
a.	\$ 200.	8 %	$\frac{1}{4}$ yr.	b.	\$100	5 %	6 mo.
c.	300	6 %	$\frac{1}{3}$ yr.	d.	400	8 %	4 mo.
e.	600	7 %	$\frac{1}{2}$ yr.	f.	500	6 %	3 mo.



*Written Exercises*

1. Mr. Rodman borrowed \$350 at 6%. How much interest is due in 84 days?

## PROCESS

$$\begin{array}{r} .01 \quad 14 \\ \$350 \times .06 \times 84 \\ \hline 360 \\ \$ \end{array} = \$4.90 \text{ Ans.}$$

Write 6% as .06 and 84 da. as  $\frac{14}{100}$  (yr.). Cancel.

2. Find interest as follows:

PRINCIPAL	RATE	TIME	PRINCIPAL	RATE	TIME
a. \$100,	8 %,	90 da.	b. \$600,	6½ %,	120 da.
c. \$200,	6 %,	45 da.	d. \$700,	6 %,	230 da.
e. \$300,	5 %,	80 da.	f. \$800,	4½ %,	125 da.
g. \$400,	4 %,	65 da.	h. \$720,	7 %,	136 da.
i. \$500,	9 %,	72 da.	j. \$360,	5½ %,	240 da.

3. How much interest is due Aug. 11, 1915, on a note for \$187.20 dated Dec. 23, 1914?

## PROCESS

$$\begin{array}{r} 23.40 \quad .005 \quad 77 \\ Int. = \$187.20 \times .075 \times 231 \\ \hline 360 \\ 120 \\ \$ \end{array} = \$9.009. \text{ Ans. } \$9.01.$$

Find the time in days by adding to the 8 remaining days in December, 31 for January, 28 for February, etc., and 11 days for August; in all 231 days.

4. Find the amount required to settle each of the following notes with interest.

FACE	DATED	PAID	RATE
a. \$120;	Jan. 16, 1914;	Dec. 6, 1914;	8%.
b. \$240;	Feb. 10, 1916;	Oct. 4, 1916;	6%.
c. \$180;	Mar. 18, 1915;	May 5, 1915;	7%.
d. \$360;	Apr. 10, 1914;	Jan. 9, 1915;	9%.
e. \$540;	May 5, 1915;	Feb. 29, 1916;	6%.

5. How much interest is due May 5, 1915, on a note for \$358.60 dated July 17, 1913?

When the time is over a year, obtain it by compound subtraction, deducting the year, the month, and the day of the earlier date from the corresponding items of the later one.

$$\begin{array}{r} 1915 - 5 - 5 \\ 1913 - 7 - 17 \\ \hline 1 - 9 - 18 \end{array}$$

Find the number of days by adding 360 days (for the year), 270 (for the 9 months) and 18; 648 days.

PROCESS

$$\begin{array}{r} .01 \quad 10.8 \\ \$358.60 \times .06 \times 648 = \$38.7288. \quad \text{Ans. } \$38.73. \\ \underline{360} \\ 60 \end{array}$$

6. Find the interest on the following:

- \$270 from Jan. 16, 1915 to Dec. 6, 1916 at 6%.
- \$330 from Feb. 10, 1914 to Oct. 3, 1915 at  $4\frac{1}{2}\%$ .
- \$450 from Mar. 18, 1915 to May 5, 1916 at 5%.
- \$180 from Apr. 12, 1913 to Dec. 4, 1915 at  $7\frac{1}{2}\%$ .
- \$510 from May 25, 1915 to July 9, 1916 at 9%.
- \$240 from Aug. 15, 1914 to Oct. 2, 1915 at 4%.
- \$720 from Nov. 12, 1916 to Dec. 9, 1917 at 5%.

**Bank Loans and Discount**

A customer of a bank who obtains a loan gives a *note* for the sum borrowed. This may be an interest-bearing note, in which case the borrower pays the face of the note with the interest at the specified time.

In the case of a note not bearing interest the bank collects the interest in advance by deducting it from the face of the note, giving the borrower the balance.

*Sight Exercises*

1. The following is a note given in settlement of an account :

<i>Davenport, Iowa, Jan. 27, 1915</i>	
<i>Ninety days after date I promise to pay to the order</i>	
<i>of-----Thomas Curriuan-----</i>	
<i>Six Hundred</i> <sup>00</sup> / <sub>100</sub> <i>-----</i>	<i>-----Dollars</i>
<i>Value received, at the Mechanics Bank.</i>	
<i>\$ 600</i> <sup>00</sup> / <sub>100</sub>	<i>William Kassenbroek</i>

2. On what day is this note due ?

**Bank Discount**

If Mr. Curriuan desires to obtain cash for the foregoing note, he can have it *discounted* at the Mechanics Bank. If he does this on Jan. 27, 1915, the bank deducts 90 days' interest, which at 6 % is \$9, and gives him the balance, \$591. This \$9 interest, paid in advance, is called the *bank discount*; the remaining sum, \$591, is called the *proceeds* or the *avails*.

**Maturity of a Note**

As a rule, a one-month note dated March 1 is due April 1; while a 30-day note of the same date is due March 31. When the specified number of days makes a note payable on a Sunday or a holiday, the next business day is taken as the date of maturity, and the new date is considered in calculating the discount.

**Days of Grace.** — Formerly the date of maturity was taken as 3 days after the time fixed by the terms of the note. These days, called *days of grace*, have been abolished in nearly all of the states. Pupils should ascertain the practice in their respective localities, and determine the discount by the prevalent method.

*Sight Exercises*

1. Find the bank discount (interest), at 6 %, on notes, as follows :

FACE	TERM	FACE	TERM
(a) \$ 600	60 da.	(b) \$ 500	120 da.
(c) \$ 400	30 da.	(d) \$ 900	90 da.
(e) \$ 100	90 da.	(f) \$ 300	60 da.

2. Find the proceeds of the following notes discounted at 6 %:

FACE	TERM	FACE	TERM
(a) \$ 100	30 da.	(b) \$ 800	45 da.
(c) \$ 500	90 da.	(d) \$ 400	60 da.
(e) \$ 900	60 da.	(f) \$ 200	90 da.

3. Find the date when the following notes are due :

DATE	TIME	DATE	TIME
(a) Jan. 26	30 da.	(b) Nov. 4	63 da.
(c) March 14	60 da.	(d) Feb. 11	28 da.
(e) May 25	90 da.	(f) April 9	30 da.
(g) July 16	21 da.	(h) June 25	15 da.

**Review***Sight Problems*

1. Find the cost of 864 yards of ribbon at  $12\frac{1}{2}$  cents per yard.
2. How much must be paid for 4 dozen hammers at  $\$1.12\frac{1}{2}$  each?
3. A dealer bought 176 yards of toweling at  $6\frac{1}{4}$  cents per yard. What was the amount of his bill?
4. At 6 pairs for  $\$1$ , how many pairs of stockings can be bought for  $\$4.50$ ?
5. Find the width of a field containing 7000 square rods when its length is  $87\frac{1}{2}$  rods.
6. If a man's purchases amount to  $\$15.29$ , how much change should he receive out of a  $\$20$  bill?
7. What is the total cost of a cloak at  $\$8.75$  and a pair of shoes at  $\$3.50$ ?
8. When dress goods are sold at  $37\frac{1}{2}$  cents per yard, what quantity can be bought (a) for  $\$6$ ? (b) For  $\$1$ ?
9. (a) At  $\$3\frac{3}{4}$  per yard, what quantity of silk can be bought for  $\$1$ ? (b) At  $\$4\frac{1}{2}$  per pound, what quantity of tea can be bought for  $\$4$ ? (c) For  $\$1$ ?
10. If a girl can do  $\frac{3}{4}$  of a piece of work in a day, how long would it require her to do the whole work?
11. What is the quotient (a) of 5 fifths divided by 4 fifths? (b) Of  $1 + \frac{1}{5}$ ?
12. The length of a field is 84 yards; the width is 3 fourths of the length. Find the width.
13. What is the area of a right triangle 84 rods long, 75 rods wide?

### Standard Weights

1 bushel of wheat = 60 lb.    1 bushel of oats = 32 lb.  
 1 bushel of barley = 48 lb.    1 bushel of corn = 56 lb.  
 1 bushel of potatoes = 60 lb.    1 barrel of flour = 196 lb.  
 The foregoing are the legal weights in many states.

### *Sight Exercises*

In the following examples use the weight legalized by your own state.

1. Give the weight of each :

- a. 150 bu. wheat.    b. 75 bu. barley.    c.  $1\frac{1}{8}$  bu. corn.  
 d. 200 bu. oats.    e. 1 pk. potatoes.    f.  $1\frac{1}{2}$  bbl. flour.

2. What part of a bushel is

- a. 30 lb. wheat?    b. 36 lb. barley?    c. 45 lb. potatoes?  
 d. 15 lb. potatoes?    e. 49 lb. corn?    f. 24 lb. oats?

### *Written Exercises*

1. Find the cost of each. Use cancellation.

- a. 3948 lb. wheat @ \$1 per bushel.  
 b. 4666 lb. oats @ 40¢ per bushel.  
 c. 8793 lb. barley @ 48¢ per bushel.  
 d. 87346 lb. flour @ \$5.60 per barrel.  
 e. 38975 lb. potatoes @ 48¢ per bushel.  
 f. 94206 lb. corn @ 60¢ per bushel.

2. How many tons of 2000 lb. each are there in a car-load of corn containing 4000 bushels?

3. How many bushels of oats weigh a ton of 2000 lb.?

4. If an acre of land yields  $87\frac{1}{2}$  bushels of potatoes, what is the weight of the potatoes raised on 64 acres?

5. If a 40-acre field averages 2750 pounds of hay to the acre, what is the yield in tons of 2000 lb.?

*Sight Review Problems*

1. How many years and months from Jan. 1, 1915, to April 1, 1917?
2. When a man is hired for 3 months from Feb. 1, on what date does his service end?
3. If a watch loses 10 seconds per day, how many minutes does it lose from noon of Aug. 1 to noon of Aug. 19?
4. In a year of 200 school days, Mary was absent 2 days. (a) What fraction of the time was she absent? (b) What decimal? John was absent 4 days. (c) What fraction of the time was he absent? (d) What decimal?
5. A baseball club played 20 games. It lost 4 games. What fraction of the games did it win? What decimal? How many hundredths?
6. If a boat uses 3 tons of coal in 24 hours, (a) what part of a ton is used in an hour? (b) How many pounds?
7. How long would a 51-gallon barrel of oil last if 3 quarts are used per day?
8. What fraction of a square foot is there in a pane of glass 10 inches long, 6 inches wide? If a box of glass contains 50 square feet, how many such panes are there in the box?
9. A rectangular piece of land is 40 rods long and 12 rods wide; how many acres does it contain?
10. (a) How many cubic feet in a cube 3 ft. long? (b) How many cubic feet in a cubic yard?
11. At  $\frac{4}{5}$  bushel to the cubic foot, how many bushels will a bin hold when it measures 5 ft. by 5 ft. by 5 ft.?
12. (a) Give three factors of 231. (b) What are the interior dimensions of a box whose capacity is 231 cu. in.?

13. At 25 cents per dozen what will the owner of 100 hens receive for their eggs when each lays, on an average, 120 eggs?

14. February 1, 1916, falls on Tuesday; what day of the week is February 29th?

15. What is the date of the first Tuesday in March, 1916?

16. Give the areas of rectangular fields having dimensions as follows:

- |                            |  |
|----------------------------|--|
| a. 168 rd. $\times$ 25 rd. | d. 72 in. $\times$ $37\frac{1}{2}$ in. |
| b. 125 yd. $\times$ 64 yd. | e. 48 mi. $\times$ $87\frac{1}{2}$ mi. |
| c. 160 ft. $\times$ 75 ft. | f. 88 yd. $\times$ $62\frac{1}{2}$ yd. |

17. Give the areas of right triangles having dimensions as follows:

- |  |                           |
|--|---------------------------|
| a. 48 rd. $\times$ $87\frac{1}{2}$ rd. | d. 72 mi. $\times$ 75 mi. |
| b. 96 yd. $\times$ $16\frac{2}{3}$ yd. | e. 88 in. $\times$ 50 in. |
| c. 84 ft. $\times$ $33\frac{1}{3}$ ft. | f. 24 rd. $\times$ 25 rd. |

18. What is the price per pound of the lean meat in a rib roast costing 20 cents per pound when 50% of it is waste?

19. A room is 21 feet long, 15 feet wide, and 9 feet high. How many square yards are there in the ceiling? How many square yards of carpet are required to cover the floor? How many square yards are in each side wall? How many square yards are in each end wall?

20. What is the total weight of 32 hams averaging  $12\frac{1}{2}$  pounds each?

21. How many bushels of wheat are raised on 84 acres at the rate of 25 bushels per acre?

22. How many cubic feet will a wagon body hold when it is 10 feet long, 3 feet wide, and 27 inches deep?



*Written Problems*

1. A planter sold his crop of 300 bales of cotton, averaging 480 lb. each, at  $12\frac{1}{2}\phi$  per pound. How many \$1000 bills would pay for the crop? (Cancel.)

2. Find the cost of 864 bags of coffee of 130 lb. each at  $6\frac{1}{4}$  cents per pound. (Cancel.)

3. A produce dealer bought 487 bbl. pork @ \$19.75 per barrel. Find the cost of the pork. (Employ a short method.)

4. When oats are  $37\frac{1}{2}\phi$  per bushel, how many bushels can be bought for \$396? (Cancel.)

5. A man pays \$4285 for a shipment of corn at  $62\frac{1}{2}\phi$  per bushel. How many bushels does he receive? (Cancel.)

6. Find the weight of 176 cattle averaging 875 lb. each. (Cancel.)

7. When wheat is selling at  $99\frac{7}{8}\phi$  per bushel, (a) what will be the cost of 1296 bu.? (b) How much less than \$1296 will be the cost?

8. At \$3.75 per yard find the price of 49 yards of velvet.

9. Find the area of a rectangle 64 rods long,  $49\frac{7}{8}$  rods wide.

10. Multiply 147 (a) by 99. (b) By 999. (c) By  $99\frac{2}{3}$ . (d) By  $99\frac{3}{8}$ . (e) By  $99\frac{7}{8}$ .

11. Divide 1462 (a) by 25. (b) By 125. (c) By  $33\frac{1}{3}$ . (d) By  $16\frac{2}{3}$ . (Give quotients in mixed decimals.)

12. What is the quotient of 147 (a) by .25? (b) By .125? (c) By  $16\frac{2}{3}\%$ ? (d) By  $33\frac{1}{3}\%$ ?

13. At  $16\frac{2}{3}\phi$  per pair, how many dozen pairs of cuffs will cost \$27?

14. At  $12\frac{1}{2}$ ¢ each how many dozen collars will cost \$25?

In the following examples first indicate the operations, then shorten the work by cancellation.

15. If  $2\frac{1}{2}$  acres of land cost \$183.60, what is the cost of  $1\frac{3}{8}$  acres, at the same rate?

PROCESS

When  $2\frac{1}{2}$  acres cost \$183.60

1 acre costs  $\$183.60 \div 2\frac{1}{2}$

and  $1\frac{3}{8}$  acres cost  $(\$183.60 \div 2\frac{1}{2}) \times 1\frac{3}{8}$

$$\begin{array}{r} 45.90 \qquad 3 \\ \$183.60 \times 2 \times 1\frac{3}{8} = \$137.70. \text{ Ans.} \\ \hline 5 \times 8 \\ 4 \end{array}$$

Reduce the divisor  $2\frac{1}{2}$  to an improper fraction, invert it and write it at once in its place, 2 above the line and 5 below. Change the multiplier  $1\frac{3}{8}$  at once to an improper fraction, and write it as shown above.

16. If  $\frac{3}{8}$  of a man's money is \$840, what is  $\frac{7}{8}$  of it?

$$\$840 \times \frac{5}{3} \times \frac{7}{8}$$

17. At the rate of \$1.64 for 2 lb. 9 oz. of pepper, what is the cost of 1 lb. 7 oz.?

Change both weights to ounces.

18. If a man can do  $\frac{3}{4}$  of a piece of work in  $4\frac{1}{2}$  days, what part of it can he do in  $3\frac{3}{4}$  days?

19. How many tons of coal will be consumed in 100 days if 100 lb. are used in  $7\frac{1}{2}$  hours?

20. A picture 18 inches long and  $10\frac{1}{2}$  inches wide is reduced by photography to one  $7\frac{1}{2}$  inches long. What is the width?

21. If a tablecloth 10 ft. square costs \$5, what should be the cost of one 12 ft. square, at the same rate?

22. If a man receives \$12.60 as interest on his money for 5 years, what interest should he receive in 7 yr. 9 mo.?

23. When 24 men dig a ditch 120 yd. long in 6 weeks, how many men will be required to dig a ditch 180 yd. long in 3 weeks?

## PROCESS

To dig 120 yd. in 6 wk. requires	.	.	.	.	24 men
" " 1 " " 6 " "	.	.	.	.	<u>24 men</u>
					120
" " 1 " " 1 " "	.	.	.	.	<u>24 men × 6</u>
					120
" " 180 " " 1 " "	.	.	.	.	<u>24 men × 6 × 180</u>
					120
" " 180 " " 3 " "	.	.	.	.	<u>24 men × 6 × 180</u>
					120 × 3

The number of men being required, write 24 men last.

To dig a ditch 1 yd. long would require  $\frac{1}{120}$  of the number of men; therefore, make 120 a divisor.

To do it in 1 week would require 6 times the number of men; make 6, therefore, a multiplier.

To dig a ditch 180 yd. long requires 180 times as many men; make 180, therefore, a multiplier.

To do it in 3 weeks requires  $\frac{1}{3}$  the number of men; make 3, therefore, a divisor.

Cancel. Find answer.

24. If it costs \$30.60 for feed for 9 horses for 17 weeks, what will be the cost of the feed required for 27 horses for 11 weeks?

25. What is the cost of digging a cellar 12 yd. long, 9 yd. wide, and 4 yd. deep, at the rate of \$120 for digging one 40 ft. long, 30 ft. wide, 9 ft. deep?

26. What is the cost of carpeting a room that is 18.5 feet long and 14 feet wide, with carpet costing \$1.25 a square yard?

27. What time has elapsed from the discovery of America Oct. 14, 1492, to July 4, 1776?

28. A man worked 153 days (excluding 22 Sundays) from July 5. What was the date of the last working day?

29. If a watch loses 10 seconds per day, how much time does it lose from 9 A.M. Aug. 1 to 3 P.M. Aug. 15?

30. A vessel uses 27 tons of coal in a day; how many pounds are used in an hour?

31. How long would a 51-gallon barrel of oil last if 8 quarts 1 pint are used per day?

32. A drover invested \$950 in sheep at \$3.80 per head. If 5% of them die, how much must he receive a head for the others in order that he may neither gain nor lose?

33. The owner of a farm of 640 acres sold  $37\frac{1}{2}\%$  of it for \$10,800. What did he obtain per acre for the part sold?

34. At 160 square rods to the acre, find the number of acres and the decimal of an acre in a field 40 rods long, 30 rods wide. What fraction of a mile of fence is required to inclose it?

35. A train travels 351 miles from 9.30 A.M. to 7.15 P.M. What is the average rate per hour?

36. A man pays 8 mills tax on each dollar his farm is valued. What does he pay on a farm valued at \$5500?

37. A merchant spent 20% of \$1650 for coffee at  $12\frac{1}{2}\text{¢}$  per pound. (a) How many pounds did he buy? (b) How many pounds of tea at 30¢ per pound could he obtain for the remainder?

38. What is the value in United States money of an article costing 25 francs, a franc being worth 19.3 cents?

39. A grocer bought 253 pounds of coffee for \$42.50 and sold it at 20¢ a pound. What was his gain?

40. (a) How many square rods are in a rectangular field 36.8 rods long, 20 rods wide? (b) How many rods of fence are required to inclose it?



## TABLES

### LINEAR MEASURE

12 inches (in.) . . . . .	= 1 foot . . . . .	ft.
3 feet . . . . .	= 1 yard . . . . .	yd.
5½ yards, or 16½ feet . . . . .	= 1 rod . . . . .	rd.
40 rods . . . . .	= 1 furlong . . . . .	fur.
320 rods . . . . .	= 1 mile . . . . .	mi.

$$1 \text{ mi.} = 320 \text{ rd.} = 1760 \text{ yd.} = 5280 \text{ ft.} = 63,360 \text{ in.}$$

A *hand*, used in measuring the height of horses, = 4 in. A *knot*, used in measuring distances at sea, = 1.15 mi. A *fathom*, used in measuring the depth of the sea, = 6 ft.

### SQUARE MEASURE

144 square inches (sq. in.) . . . . .	= 1 square foot . . . . .	sq. ft.
9 square feet . . . . .	= 1 square yard . . . . .	sq. yd.
80½ sq. yd., or 272½ sq. ft. . . . .	= 1 square rod . . . . .	sq. rd.
160 square rods . . . . .	= 1 acre . . . . .	A.
640 acres . . . . .	= 1 square mile . . . . .	sq. mi.

$$1 \text{ A.} = 160 \text{ sq. rd.} = 4840 \text{ sq. yd.} = 43,560 \text{ sq. ft.}$$

A *Section* of land is a square mile.

Roofing, flooring, and slating are often estimated by the *square*, which contains 100 square feet.

### SURVEYORS' MEASURE

In measuring land, surveyors use a chain (ch.) which contains 100 links (l.) and is 4 rods long. Since the chain is 4 rods long, a square chain contains 16 sq. rd., and 10 sq. ch. = 160 sq. rd., or 1 acre.

### CUBIC MEASURE

1728 cubic inches (cu. in.) . . . . .	= 1 cubic foot . . . . .	cu. ft.
27 cubic feet . . . . .	= 1 cubic yard . . . . .	cu. yd.
128 cubic feet . . . . .	= 1 cord . . . . .	cd.
16 cubic feet . . . . .	= 1 cord ft. . . . .	cd. ft.
8 cord feet . . . . .	= 1 cord . . . . .	cd.

**NOTE.**—In computing the contents of an enclosing wall, masons and brick-layers regard it as one straight wall whose length is the distance around it on the outside. Corners are thus measured twice.

A *perch* of stone or masonry is 16½ ft. long, 1½ ft. thick, and 1 ft. high, and contains 24½ cu. ft.

This textbook may be borrowed for two weeks, with the privilege of renewing it once. A fine of five cents a day is incurred by failure to return.

#### LIQUID MEASURE

1 gills = 1 pint . . . pt.  
2 pints = 1 quart . . . qt.  
4 quarts = 1 gallon . . . gal.

#### DRY MEASURE

2 pints = 1 quart . . . qt.  
8 quarts = 1 peck . . . pk.  
4 pecks = 1 bushel . . . bu.

The *standard gallon* contains 231 cubic inches.  
The *standard bushel* contains 2150.42 cubic inches.

The capacity of cisterns, reservoirs, etc., is often expressed in barrels (bbl.) of 31½ gallons each, or in hogsheads (hhd.) of 63 gallons each. In commerce, these vary in size.

#### AVOIRDUPOIS WEIGHT

16 ounces (oz.) . . . = 1 pound . . . lb.  
100 pounds . . . = 1 hundredweight . . . cwt.  
2000 pounds . . . = 1 ton . . . T.

One pound Avoirdupois = 7000 grains.

The *long ton* of 2240 pounds is used in the United States Custom Houses and in weighing coal and iron at the mines.

#### STANDARD WEIGHTS

1 bushel of wheat . . . = 60 lb.	1 bushel of potatoes . . . = 60 lb.
1 bushel of corn . . . = 56 lb.	1 barrel of flour . . . = 196 lb.
1 bushel of oats . . . = 32 lb.	1 barrel of pork . . . = 200 lb.
1 bushel of barley . . . = 48 lb.	1 keg of nails . . . = 100 lb.

#### TROY WEIGHT

24 grains (gr.) . . . = 1 pennyweight . . . pwt.  
20 pennyweights . . . = 1 ounce . . . oz.  
12 ounces . . . = 1 pound . . . lb.

One pound Troy = 5760 grains.

#### APOTHECARIES' WEIGHT

60 grains (gr.) . . . = 1 dram . . . dr., or ⅓.  
8 drams . . . = 1 ounce . . . oz., or ⅕.  
12 ounces . . . = 1 pound . . . lb., or ⅓.

One pound Apothecaries' weight = 5760 grains.

#### BRITISH OR STERLING MONEY

4 farthings . . . = 1 penny . . . d.  
12 pence . . . = 1 shilling . . . s.  
20 shillings . . . = 1 pound . . . £.  
5 shillings . . . = 1 crown.

The value of £1 is \$4.8665 in United States gold coin.

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